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FISHING CHIMES

UPGRADES CAPABILITIES ; AUGMENTS OUTPUT

- Pearl Culture in India
- Sun dried *Jawala* Prawns : Radiation Processing
- Saurashtra Women in Fisheries Sector
- Punjab CRPF Jawans are fish producers too

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Fishing Chimes

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Notified change in Telephone nos.

The Telephone authorities (BSNL) have given notice that the present telephone nos. of *Fishing Chimes* would be changed soon. The date from which the change will be made effective, would be published soon, it is stated.

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FISHING CHIMES

Utilisation of Fisheries of Indian EEZ : Reflections on Policy Options

The Indian marine fishing industry has been eagerly awaiting, for the past few years, the announcement of a comprehensive national policy for the development of fisheries of Indian EEZ by the government of India. The latest known on the subject is that a policy formulation group set up by the government for the purpose has submitted its report quite sometime back. Even allowing for the generally known complacency of the government towards development of fisheries of the nation, the ongoing delay in the announcement of the policy may soon prove to be against national interest.

India, possessing 2.017 miilion sq km of EEZ and situated strategically in the Indian ocean region, possesses all the positional advantages of being a leader (Alas! not-excercised) among the nations of the region. Considering the underexploited open sea and deep sea marine fisheries resources and over exploited coastal resources, the nation deserves to be endowed with a purposeful, forward-looking and dynamic policy for their sustainable utilisation. And such a policy has to replace the present one, which is mainly corrective in nature, and is aimed at ridding the country of undesirable operations of chartered, leased and joint venture foreign vessels. This corrective job having been more or less accomplished, no doubt government is working on replacing these undesirable operations with a more nationally-oriented system, but the time lag is far too inordinate. So far as coastal fishing is concerned, there have been no initiatives at diversification of fishing effort in the Zone, so as to reduce fishing concentration on conventional resources. There is thus a policy vacuum.

This policy vacuum has led to an interesting development that has unwittingly served to test the possible swing in the mood of the industry in respect of strengthening of the depleting larger vessel fishing fleet. The test took place through a notification of ministry of commerce amending the rule related to import of vessels to provide for acquisition of used vessels by Indian enterprises. This notification, as can be understood and appreciated, primarily invoked the interest of those with experience and contacts with owners of foreign fishing vessels who gave their vessels earlier on charter/lease basis to them for operation in Indian EEZ. The result is that several of them have availed of the opportunity that the amendment provided. It is learnt that 32 vessels have been imported by them, registered under Indian flag and put in operation, with an arrangement for the payment of the cost of the vessels on 'deferred' basis. As it turned out, for the foreign fishing vessel owners, this was a good alternative opening to gain access once again to fish in Indian EEZ and, for the Indian enterprises it provided an opportunity to revive the earlier practice of vessel-oriented exports without unloading and through an export-link up, although in a different capacity. Technically the imported vessels are now their own, despite the belief in certain circles that the de facto ownership continues with the foreign owners. For the Ministry of Commerce, it seems that the imports are apparently a means to augment value of marine products exports, which have been sagging, of late.

As can be seen, this vessel import route, based on 'deferred payments', solves the problem of investments and at the same contributes to exports. Despite these advantages, several in the sector feel that this route may give rise to certain diadvantages. Firstly, this route is not amenable for utilisation by the general run of fishery enterprises. Another aspect is that, for the operation of the vessels, reliance has to be totally on foreign crew. The induction of Indian counterpart crew will be in the nature of a formal presence, as the foreigners, for obvious reasons, do not have interest in providing training to Indian crew, as had been the past experience under the erstwhile charter/lease scheme. And, as may have been noted, the present used vessel import activity happens to be an inverted system of the erstwhile charter scheme. In a way, there can be no sense in having this system with the present contours, which tantamounts to a virtual revival of the erstwhile scheme (old wine in new bottle). Further, the Indian 'owners' may not practically have any control over the movements of the vessels once they leave the port. The past practice had been that they move to areas in or outside the region depending on the fishery complexion. In other words, the return of the vessels for the next voyage can be beyond the control of the 'Indian owners'. Whatever be the conclusion, considering that the main resource available for exploitation is pelagic tuna, and there being practically no trained Indian hands in tuna longlining, there seems to exist an urgent need for expanding training infrastructure, either on the imported tuna vessels or elsewhere, to build up a cadre of trained men in tuna long lining for utilising their services on a truely Indian tuna fleet

which will indoubtedly emerge soon.

Only a small section of foreign vessel owners, that too mostly those from Taiwan and Thailand, have interest in fishing in Indian EEZ for traditional reasons and because of their close knowledge of Indian situation. Because of this only those with earlier contacts with foreign vessel owners could succeed in the import of used vessels. This situation appears to have unleashed professional conflicts in the industry. Several other issues could have also surfaced. Consideration of these aspects, in all likelihood, may have delayed the announcement of the new policy by the government.

It is not that all those who imported used fishing vessels are happy. Reports speak of registration of 32 used foreign vessels under Indian flag. Half of these are trawlers and the remaining are tuna long liners, as the information goes. Most of these have been idle, despite registration as Indian vessels, because of apprehension by coastguard for some reason or the other and some are stated to have fled because of fear of apprehension (Despite the fact that they are registered as Indian Vessels). The latest development, however, is understood to be that, government have decided to allow the tuna long liners to operate probably because it is a passive fishing system and the trawlers are not allowed apparently for the reason that trawling is a dynamic fishing system. This approach, if true indicates the approach that can be there in the policy to come, which may not in any case be delayed for long.

'Arranged' import of used vessels with export linkage is certainly an easier option but many consider this as a solution that compromises national honour, because of its inherent manipulative features, as attrubuted. It is not known whether the government is considering other options that would be much more direct for effectively utilising the known unexploited resources of Indian EEZ such as high sea tuna, Oceanic squid and cuttle fish ,deep sea shrimp and lobsters. Whatever be the options government may be considering, it appears that a sustainable option may lie in developing an integrated institutional mechanism that would channelise the energies of such of those fishery enterprises that have a record of experience in fishing with larger vessels to participate in the operations for catching tuna, squid, cuttle fish, deep sea shrimp/ lobsters etc., with an integrated approach.

The Ministry of Agriculture set up an integrated Fisheries Project in 1970s with the objective of demonstrating and promoting integrated projects in the private sector, as a follow-up to the effective and devoted work done by its predecessor, the Indo-Norwegian project. Keeping this historic promotional work done by this project in view, the Integrated Fisheries Project could now be geared up to perform the function of promoting projects for the integrated utilisation of the aforesaid resources, possibly by taking the help of NORAD, which has vast experience in the line. In this connection, it will be recalled that NORAD had earlier helped India so much in a consistently dedicated manner in the introduction and popularisation of fishing with mechanised boats in India's coastal waters and also in the survey of deepsea fishery resources. Their assistance could be sought again to take the industry further forward, at this juncture of being at cross roads for want of finance and expertise in certain respects. In the alternative, assistance from Australia which too has experience in long lining for tuna and in the exploitation of deep sea resources, could be availed of.

Apart from taking help in the promotion of high sea fishing, more specifically longlining, for tuna, deep sea fishing for lobster, shrimp, squid etc., there is another angle for obtaining Norwegian or Australian help.

As is widely known, there have been no tangible efforts so far at introducing and promoting sea cage farming in India. It is significant that this aspect had also been highlilghted by no less a person than Dr. K. Gopakumar who was Deputy Director General (Fy), ICAR, at the CIFT-Industry Meet held in Visakhapatnam recently. This can be interpreted as an admission of the lapse.

Both Norway and Australia have enormous experience in cage farming in protected as well as open sea waters. While cage farming has become a routine activity in Norway and several other countries as a sustainable method of augmenting fish production, India remains uninfluenced by the idea. However, some years back, one Indian entrepreneur made strenuous efforts at great expense to install a cage farming system in Andaman waters but either short sightedness or some other factor prevented the authorities concerned from encouraging the endeavour. Thus a great opportunity of introducing sea cage farming was lost.

In this background, marine fisheries policy could include the promotion of cage culture of fishes such as groupers, snappers, sea bass etc., in protected as well as offshore waters of Indian EEZ, taking due care of aspects such as providing sites on long term lease to entrepreneurs supported by needed surveys and other help from NORAD or Australia for setting up hatcheries on shore, for providing seed supplies to cages and for providing training and other inputs. Sea cage farming can add to national fish production and exports significantly and compensate for the declining marine capture fishery output.

There are examples of several countries augmenting their sagging fish production through cage farming. Two recent ones out of these are mentioned as follows.

Cage culture of Yellowfin tuna has been taken up in Mexican waters, yielding encouraging results. India is now not in a position to visualise taking up any such project and this is unfortunate. Greece provides another example of the operation of tuna cage farms on a commercial scale.

A report in ***Fish Farming International*** *(May 2002 issue) says that a privately owned Mexican company has just begun growing yellowfin in cages off Mexico's Pacific coast. Cage culture of tuna in waters around 360 m distant from an island*

and at a depth of about 40 ft has been taken up. There is a promising future for warm water mariculture on the continental shelves, near islands where the presence of strong currents, lack of pollution and low nutrient waters offer excellent sites off shore for cage culture, it is mentioned. The new habitat created by the cages and the small amount of faecal discharges into the open sea are seen to significantly increase the concentration of marine life around cages, besides the fish that are grown in the cages.

Barges equipped with onboard freezer for holding frozen feed consisting of sardines and mackerel for feeding cage fish, accomodation for crew, power generating system, and with facility for cage observations are stated to have been pressed into use in that country.

The present day offshore grow-out cages are well advanced in design with lower maintenance requirements and greater endurance in rough weather. Polyethylene cages as big as those having 42 m dia are used. 48 ha of area is allotted for setting up a cage farm to each of the enterprises by the Mexican government.

Tow-cages, different in design to grow-out cages are towed to centres where tuna juveniles are available and which are caught by tuna vessels. Such cages are used for collecting tuna juveniles for transfer to grow-out-cages. For harvesting, a net is placed inside the main cage to concentrate the fish on it and a gaffing platform from which to pull fishes individually is used. They are killed on site, and carefully cleaned before rapidly chilling them for quick transport to the market.

It is also reported in ***Fish Farming International*** *(May 2002 issue) that in Greece, a company by name Nireus SA operates three marine fish hatcheries, 18 cage farms, four EU certified packing plants and one processing plant. Each of the cage farms has a grow out capacity to produce 1187 t/cage. 19 m dia HDPE circular cages are used, besides barge feed transport system. The possibilities of securing expertise from NORAD or Australia or Nireus Group of companies (1st Km Koropiore-varis Ave, 19400 Koropi, Greece: Fax +30 10 6626803, Website: www.nireus.com) can possibly be explored for the introduction of commercial sea cage culture in Indian seas. CMFRI can probably play a significant role in this respect, through taking up experimental programmes of sea cage culture and eventually taking up schemes for providing training to entrepreneurs in cage farming technologies, as a part of a collaborative project, thereby paving the way for the popularisation of sea cage culture in Indian EEZ.*

Letter to the Editor

Dear sir,

This is with reference to the article of Dr. A. Srinivasan (May 2002 issue of *Fishing Chimes*) on the severe erosion on the Ennore-Pulicat Coast. This is what I have been trying to elaborate in several of my own articles on the Coastal Zone; Areas adjacent to estuarine/creek/lagoon/Bay mouths which are potential erosion - hazard zones. Any construction activity, be a Fishing Wharf, a deepwater port, a land reclamation for building godowns, location of a port, thermal plant or whatever, would have a severe impact on the coastal sands. Exposed to daily tidal action and small and big littoral drifts there is a great tendency for movement of sand covering vast distances. Marshes, mangrove beds, molluscan beds, all these are most severely impaired by dredging activity undertaken for construction.

Thermal plants and nuclear plants are located on the coastal zone because of the easy availability of huge quantities of water required for cooling. The thermal effluents with vast temperature variance from the ambient temperatures kill immense quantities of planktoic organisms. There is thus genetic fouling of the environment besides other adverse impacts.

Is any one of the policy makers serious about environmental impacts and disastrous effects on fisheries etc? **We seem to cry in wilderness!**

Kakinada, A.P. ***T. Rajyalakshmi (Dr.)***

Government reduces duty on Artemia Substantially

The A.P. Shrimp Hatchery Owner's Association, with the support of the Shrimp Hatchery Owners in other coastal States have succeeded in convincing the government on the need for substantially reducing the customs duty on Artemia, widely used by shrimp hatcheries for feeding shrimp larvae. Because of the high cost of artemia, the production cost of shrimp seed has soared to such a level that the hatchery owners have been experiencing serious problems in selling the seed to the farmers at a rate workable to them for stocking their shrimp ponds. The main reason for their inability to sell shrimp seed even at the production cost is the severe fall in the quantity of shrimp produced per hectare because of the heavy mortalities consequent to the incidence of white spot disease. In this situation, the net result is that the hatchery owners are forced to sell shrimp seed at a price as low as 10 paise per piece, thereby losing heavily. The present reduction in duty will now bring down the cost of artemia, thereby providing substantial relief to the hatchery owners and farmers alike.

It is estimated that, considering the production of 10 billion shrimp seed per annum in India by around 220 hatcheries, it is estimated that the hatchery owners will get a relief of Rs.3850/- per billion of seed produced, consequent to the reduction of duty on imported artemia cysts from 40% to 15%. The saving of 25% of customs duty, which comes to Rs.550/-/kg of artemia, (taking the cost of can of 450 g of artemia cysts as Rs.1000/-). on this basis, it is estimated that the shrimp hatchery industry as a whole would be benefited by not less that Rs.50 lakhs by way of savings in their production cost.

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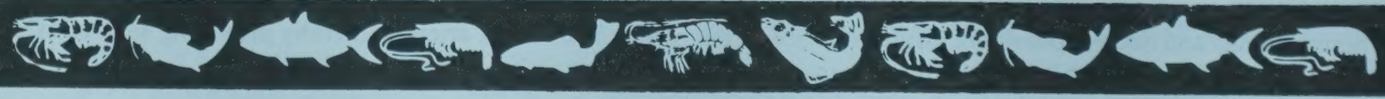

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National Symposium ON

Fisheries Enhancement in Inland Waters : Challenges Ahead

Central Inland Capture Fisheries Research Institute (CIFRI)
Barrackpore 743101, 27-28 April 2002

A National Symposium on 'Fisheries Enhancement in Open Waters : Challenges Ahead' was conducted at the Central Inland Capture Fisheries Research Institute, Barrackpore, on 27 and 28 April 2002. It was sponsored jointly by the Inland Fishery Society of India and the Central Inland Capture Fisheries Research Institute.

The symposium was inaugurated at Sukanta Sadan, Barrackpore, by the well-known fisheries scientist of international repute and former Member, Indian Planning Commission, Dr. S. Z. Qasim. A galaxy of renowned fishery scientists, academicians, technocrats, developmental authorities, extension functionaries, researchers, students, progressive fish farmers and several other dignitaries from different parts of the country were present at the inaugural function.

Welcome Address

Dr. V. V. Sugunan, Director, CIFRI and President of Inland Fisheries Society of India, Barrackpore, welcomed the chief guest and other dignitaries. As part of

Dr. V.V. Sugunan, Director, CIFRI, delivering welcome address

Dignitaries on the dais (R to L) : Dr. V.V. Sugunan, Director, CIFRI, Dr. S.Z. Qasim, former Member, Planning Commission, Dr. B.N. Singh, Asst Dir Genl (I.Fy.), ICAR and Mr. R.A. Gupta, Principal Scientist, CIFRI

Dr. S.Z. Qasim lighting the auspicious lamp to signify the inauguration of the symposium

A section of the audience

Dr. S.N. Dwivedi opening Aqua Fair 2002

Honorary Fellowships of Inland Fisheries Society of India were conferred on nine eminent Scientists of India

Dr. S.N. Dwivedi

Prof. T.J. Pandian

Dr. S. Ayyappan

Dr. G.P. Dubey

Dr. B.N. Singh

Dr. Y.S. Yadava

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Prof J.S. Datta Munshi

Dr. S.D. Tripathi

his address, Sugunan elaborated the concept and rationale behind the topic of the Symposium. Explaining that the country needed increase in fish production to provide nutritional security to its people, he added that this could be attained through adoption of a sustainable and eco-friendly approach. The Director apprised the participants about enhancement technologies, which he said had a greater relevance to the efforts to increase fish production. In the fast changing world scenario, the enhancement technologies were *sine-qua-non*, Sugunan pointed out. While highlighting the efforts and achievements of CIFRI, he said that it had a glorious history of service to the inland fisheries sector of the nation to be proud of and the technologies developed by the Institute during the last five decades had virtually revolutionised the status of inland fish production in the country. Elaborating, he explained that, during 1950s, the period in which first five-year plan began, the inland fish production of India was a meagre two lakh t, which had now increased to 28 lakh t making the nation the second largest inland fish producer in the world. This 14-fold quantum jump in inland fish production became possible due to the relevant technologies developed at CIFRI, the premier research Institute and which were extended to the farmers.

Bringing out the relevance of open water fisheries enhancements, the Director said that such fish production systems, being less capital intensive and more labour intensive, could provide ample opportunities for generating gainful employment in rural sector, the key for overall development of the nation. The present Symposium on fisheries enhancement, therefore, assumed great significance from socio-economic perspective, especially in the backdrop of recent setback in shrimp aquaculture, he elaborated. Stating that enhancement technologies were highly relevant for India, having more than 1.5 million ha of small reservoirs amenable for culture-based fisheries, he said that increase in fish production through culture-based fisheries and other forms of enhancement, especially in small reservoirs (>1000 ha), had been found very lucrative around the globe. Fisheries enhancement was all the more essential in thickly populated countries like India in order to provide protein-rich nutrition to their teeming populations, besides enhancement of the standard of living of people living in rural areas, he concluded.

Mr. Kiranmay Nanda, Minister for Fisheries, Govt. of West Bengal, who was to inaugurate the symposium had sent a message expressing regret for his inability to participate in the function owing to certain sudden circumstances that necessitated his departure to an out-station on inescapable official business. In his message (read in *absentia*), he lauded the efforts made and technologies developed by CIFRI, Barrackpore, for the development of inland fisheries sector of the country. Nanda expressed satisfaction that the State of West Bengal remained the top fish producing State among the various States of the country, for the last several years, contributing around 31% to the total inland fish production. He expressed the view that emphasis should be on moving towards harnessing of alterna

tive resources having ample opportunities for various forms of enhancements in an eco-friendly manner.

Inaugural Address

The Chief-Guest, Dr. S. Z. Qasim, in his inaugural address, recalling that 'Calcutta is a city of Science', and congratulating Dr. Sugunan and his scientists for conducting this important symposium, pointed out that while yields from inland culture and capture-based culture fisheries sector of India was well within sustainable limits, marine capture fish production in the coastal zone of the country had crossed limits of sustainability. Observing that this situation needed immediate attention, he advised the scientists and others associated with the fishery sector, to develop suitable eco-friendly technologies for achieving targeted growth rate on sustainable basis without impeding the normal functioning of natural ecosystems. Referring to the effects of pollution on riverine fish stocks, he pleaded for immediate measures to restore riverine fisheries to their earlier glory. He appealed for taking special steps to develop fisheries of small reservoirs also, considering their production potential. Raising the standard of living of rural poor was essential to ensure overall development of the nation and to achieve this, fisheries enhancement in open waters could play a significant role, he said in conclusion.

Honorary Fellowships of IFSI

Honorary Fellowships of Inland Fishery Society of India were conferred on eleven eminent Scientists of the country on the occasion. The recipients of Honorary Fellowships of IFSI were Dr. S. N. Dwivedi, Dr. S. D. Triapthi, Dr. J. S. Dutta Munshi, Prof. T. J. Pandian, Dr. G. P. Dubey, Dr. Y. S. Yadava, Mr. J. V. H. Dixitulu, Dr. S. Ayyappan, Dr. B. N. Singh, Dr. S. A. H. Abidi, and Dr. M. Y. Kamal. Fellowships were also awarded to Prof. A. R. Khudabaksh, Dr. H. S. Sehgal, Dr. Anup Dutta, Dr. Bidhan Patra, Dr. A. K. Mandoloi and Prof. K. K. Sharma. Dr. S. Z. Qasim, the doyen of Indian Marine Sciences, conferred the Fellowships.

Aqua-fair 2002

An exhibition, Aqua-fair 2002 was organized on the occasion in CIFRI Campus, Barrackpore. Dr. S. N. Dwivedi, former Director, CIFE, Mumbai and Ex-Director General of Science and Technology, Madhya Pradesh opened the fair. The main attractions of the fair were the stalls of CMFRI, CIFRI, CIFT, CIBA, CIFA, CIFE, NRC on Coldwater fisheries, and NBFGR at which the achievements of the respective institutes were highlighted. The exhibition was also participated by many other research Institutes, industrial and trade establishments and NGOs.

Invited Presentations

One highlight of the Symposium was a Session on invited lectures conducted at the main auditorium of CIFRI. The Session was chaired by Dr. K. V. Devaraj. Eight invited talks were delivered in the Session by eminent fishery scientists of the country. T.J. Pandian, National Professor, Madurai Kamaraj University delivered an inspiring talk on *Genetic strategies to augment fish growth*. This was followed by S. N. Dwivedi's lecture on the subject, *Reservoirs - the major resource for enhancing inland fish production in India*. Describing reservoirs as sleeping giants, he presented an assessment of the fish production potential of reservoirs in India and spoke on the policies and strategies for achieving higher productivity from them. Proposing people's participation in reservoir fishery project formulation and management, he laid focus on the importance of reservoirs as major areas of fishery development, while describing them as commercially viable economic entities. S. D. Tripathi dwelt on role of *Aquaculture in rural development and prosperity*. He brought out sharply the importance of aquaculture in providing livelihood, incomes and food security in rural India. He had argued convincingly that capture and culture fisheries could provide much more work and income to the rural poor especially to women. S. Ayyappan provided a broad outline of the HRD needs of the fisheries sector. While projecting the demands for the sector in the days to come, he advocated the need for development of skills in a planned manner in order to meet the challenges ahead. J. V. H. Dixitulu made a comprehensive presentation covering various aspects of aquaculture practices, reservoir fisheries development and species introductions. He argued forcefully for introduction of useful exotic species especially *Oreochromis niloticus* which could be cultured for increasing production as well as export, following monoculture practices in a manner that would ensure environmental safety. His suggestions for setting up Reservoir Fisheries Development Agency as an organisational mechanism to promote the development activity in an integrated manner through the identification of Reservoir Cluster Wraps were well appreciated by the audience. B. N. Singh spoke on the challenges in managing the inland fisheries resources in India. K. K. Vass made a forceful appeal for mounting special efforts to promote sport fisheries and upland lake fisheries. G. P. Dubey talked about experiences in Madhya Pradesh in respect of reservoir fisheries development and the lessons it offered to the country for adoption.

Technical sessions

The delegates were split into three groups. Each of the earmarked groups participated in the concerned concurrent Technical Sessions held. The Technical session I on *Biological and environmental implications of enhancements*, held in the main auditorium, was chaired by Dr. S. N. Dwivedi and Mr. J.V. H. Dixitulu. Fifty-five papers were discussed in the Session. Mr. V. K. Murugesan and Mr. M. Kartikeyan were the rapporteurs. The Technical session II on *Resource-based Approach and Development strategies* was held in the Communication Centre of CIFRI. Drs. S. D. Tripathi and S. Ayyappan respectively chaired and co-chaired the session and Drs. R. K. Tyagi and A. K. Sahoo recorded the proceedings. Forty-two papers were discussed in the Session. Drs. B. N. Singh and K. K. Vass respectively chaired and co-chaired the Session on Socio-economic

aspects and institutional arrangements of enhancement, held in the Conference Hall. Dr. (Mrs.) Usha Mosa was the rapporteur. The Session discussed the contents of fourteen papers.

The captions of the papers contributed along with the names of the authors are given hereunder.

Session - 1: Biological & Environmental implications of enhancements

- Water quality characteristics and trophic status of Chopal reservoir in Punjab : *H.S. Sehgal, S.S. Hassan, G.K. Sehgal and Kamaldeep Kaur.*
- Preliminary trials on induced breeding of *Labeo gonius* in Tarai region of Uttranchal : U.P. Singh, R.N. Ram, D.V. Singh, Swati Bisht and K. Mehta.
- Plant extract formulated feed as a preventive measure against aquatic pollutants for fishes : *A. Nath and Prakriti Verma.*
- Fish production in a tilapia dominated perennial tank : *Ravi Shankar Piska, V. Divakarachary and Murali Krishna.*
- Observations on some hydrobiological features of lake Mirik in Darjeeling Himalayas : *Prithwiraj Jha and Sudip Barat.*
- Chemical properties of water of Uttar Pat (*beel*) of Bishnenpur District : *Kh. Rajmani Singh.*
- Histopathological changes in the various organs of *Catla catla* Ham. infected with myxozoan parasites : *Sanjoy Kumar Banerjee, B.C. Patra and J. Maity and B. Sarkar.*
- Changes of the blood parameters in *Catla catla* (Ham.) due to myxozoan parasite infection : *Sanjoy Kumar Banerjee, B.C. Patra, Partha Bandyopadhyay and Arup Tiwary.*
- Aquatic weeds *Nechamendra alternifolia* and *Nymphoides cristatum* as feed for the Indian major carp *Labeo rohita* (Ham.) : *S. Patra, J. Debnath, P. Bandyopadhyay, J.Maity, A. Tewary and B.C. Patra.*
- A survey of nuclear anomalies and nucleo-cytoplasmic ratios in peripheral erythrocytes of *Hilsa ilisha* collected from some strategic regions of the Hooghy-Matlah river system : *P. Mallick, K.C. Mohanty and A.R. Kauda-Bukhsh.*
- Ag-NOR locations in two species of ornamental fish : *Jayanta Kumar Das and A.R. Khuda-Bukhsh.*
- Effect of Satavari feeding on carp fishes : *A.P. Rao, A.C. Pandey & N.P. Tewari.*
- Effectiveness of biological control of weeds through aquaculture case study : *S.M. Misra, S. Panu and A. Bajpai.*
- Studies on the seasonal pattern of flora and fauna of two freshwater ponds in Paramanandapur, Midnapore : *Kartik Maity, B.C. Patra, B. Mandal and G. Bhandari.*
- Macrophyte inhabiting macro-benthic invertebrates of Birauli oxbow lake, Samastipur : *Poonam Prakash and Motilall.*
- Assessment of correlation of genotoxicity and nuclear anomalies in fish treated with Ethyl Methane Sulphonate (EMS) : *Bibhas Guha and A.R. Khudabaksh.*
- Microscopic studies on thymus gland of a gobiid fish : *Subrata Kumar De and S.G. Pal.*
- Influence of zinc on production of fish *Cyprinus carpio* : *Debi Prosad Sarkar and Sushil Kanta Konar.*
- Bacteriological and histopathological studies on the diseased *Penaeus monodon* from semi-intensive culture ponds of West Bengal : *Debasis Sasmal, Dibyendu Kamilya, T.A. Qureshi and T. Jawahar Abraham.*
- Antibiotic resistance in bacterial flora of shrimp farming systems of West Bengal : *Arunabha Barman, Debasis Sasmal and T. Jawahar Abraham.*
- Physiological changes in a freshwater catfish, *Heteropneustes fossilis* following exposure to cadmium : *Ravij Kumar Srivastava, Hari Shankar Singh and Shivaji Srivastava.*
- Efficacy of copper as a micro-nutrient for the fingerlings of *Heteropneustes fossilis* (Bloch) : *A.K. Gupta and C. Singh.*
- Role of hardness of water and soil sediments on the bioavailability and toxicity of lead - an experiment for enhancement in the survivability of scale carp, *cyprinus carpio communis* (Linn.) under polluted ecosystem : *Subhendu Datta, A. Singh and R.C. Das.*
- Effects of pimozide and LH-RH on induction of ovulation in some teleosts : *Swapan Kumar Bhattacharyya.*
- Dairy effluent - a potential resource for aquaculture : *S.P. Rai, A.K. Datta, S.K. Majumdar, B.K. Pandey and S.K. Manna.*
- Rearing of *Cirrhinus reba* in sewage-fed pond : *A.K. Datta, S.P. Rai and S.K. Majumdar.*
- Surface structure of resting eggs of some rotifer species : *Sukanta Benik.*
- Comparative pond ecology and fish production in silted and desilted ponds : *U.P. Singh, V.K. Singh, R.S. Chauhan and D.V. Singh.*
- Breeding of Asian catfish, *Clarias batrachus* in a simulated paddy field condition : *A.K. Sahu, T. Swain, B.Mohanty, A. Mitra and S.K. Sahoo.*
- Detection of *Aeromonas hydrophila* in fish using nitrocellulose enzyme immunoassay : *S.S. Mishra, S.K. Manna, P. Maurye, M.P. Brahmane and A.Hajra.*
- Effect of low and high pH on some physiological response of *Labeo rohita* fingerlings : *Tanusree Datta, S. Acharya and M.K. Das.*
- Productivity trends in two floodplain wetlands of Bihar : *D. Palai and B.C Jha.*
- Habit and habitat gradient accumulation of metals in three carp species

under variable exposure in sewage-fed wetlands in Kolkata, West Bengal : *Paulami Maity and S. Banerjee.*

- Fish proteomics and fish protein databases - biotechnological approaches for enhancing fish production : *Bimal P. Mohanty.*
- Oxycline - a prime productive criteria for Manchanbele reservoir (Karnataka) : *A.K. Das.*
- Differential phosphorus loading from constituent rivers in a tropical south Indian reservoir, Hemavathi : *R.K. Manna and A.K. Das.*
- Impact of anthropogenic interference on the ecology, fisheries and fishers in the river Damodar : *B.K. Biswas and S.K. Konar.*
- Heavy metals in water of the rivers Hooghly and Haldi at Haldia and adjoining industrial outfall zone : *S. Samanta, K. Chandra, K. Saha, S. Bandopadhyay and A. Ghosh.*
- Soil and water nutrients in Tamil Nadu reservoirs : *Rani Palaniswamy, V.K. Murugesan and S. Manoharan.*
- Ecology and fisheries of small reservoirs of eastern Uttar Pradesh : *A.K. Laal, R.N. Seth, B.K. Singh, P.N. Jaitley and R.S. Panwar.*
- Energy dynamics of beels : *V. Pathak, Baldir Singh, L.R. Mahavar and B.D. Saroj.*
- Ecological status of river Tapti near Surat, Gujarat : *M.K. Mukhopadhyay, K. Chandra, S.N. Singh, V. Kolekar, R. Saha, R.C. Mandi and S. Das.*
- Evaluation of rapid fish health assessment methods ~ a case study in fishes of river Hooghly : *M.K. Das, S. Samanta and S. Bhowmick.*
- Status of benthic fauna in some selected reservoirs in Andhra Pradesh, India : *P.K. Sukumaran and A.K. Das.*
- Assessment of pollutants on limnochemical factors of river Ganga between Kanpur and Varanasi : *H.P. Singh and L.R. Mahavar.*
- Ecology and fisheries status of Keetham lake in early nineties : *Vijay Kolekar.*
- Limnology and fish yield enhancements through stocking in Markonahalli reservoir : *D.S. Krishna Rao, M. Ramakrishniah, M. Karthikeran & P.K. Sukumaran.*
- Heavy metal contents in Sunderaban estuaries : *D. Nath, R.N. Mishra, S. Mandal, Keya Saha and D. Biswas.*
- Physico-chemical characteristics of some semi-intensive fish culture ponds of West Bengal, India : *D. Nath.*
- Nutrient dynamics in the floodplain wetlands of West Bengal : *A.K. Das.*
- Application of molecular diagnostic for infectious diseases of shrimp : *S.S. Mishra and M.S. Shekhar.*
- Fishery and biology of *Gudusia chapra* from Panchita beel of West Bengal : *M.K. Bandyopadhyay, G.K. Vinci and Subhra Saha.*
- Status of benthic community in river Cauvery : *D.N. Singh, P.K. Sukumaran and A.K. Das.*
- The influence of water quality on the productivity of reservoirs in Tamil Nadu : *V.K. Murugesan, Rani Palaniswamy and S. Manoharan.*

Session - II : Resource based approach & development strategy

- Prospects and problems of inland water fisheries of district Muzaffarnagar in Uttar Pradesh : *Nagma, M.S. Siddiqui and N.S. Rehmani.*
- A case study of fish productivity in a small irrigation reservoir ~ Barnoo (M.P.) : *Aravind Kumar Mandloi and Praveen Ojha.*
- Problems and prospects of culture-based fishery in beels (wetlands) of Assam : *A. Wakid and S.P. Biswas.*
- Experiment on carp culture in upland stream conditions : *K.D. Joshi and B.C. Tyagi.*
- Fish diversity and fishery of a reservoir on river Krishna at Vijayawada : *S.V. Sharma, T.J.S. Alankara Rao and B.C. Giri.*
- Current status of fisheries of Leond tal with special reference to its fisheries enhancement : *S.K. Singh and P.N. Pande.*
- Species enhancement by the introduction of exotic carp, *Cyprinus carpio* in Umiam reservoir of Meghalaya, North eastern India - an overview : *K. Vinod, B.K. Mahapatra, and B.K. Mandal.*
- Stocking of Indian major carps in Umiam reservoir of Meghalaya - an approach for culture-based fisheries : *B.K. Mahapatra, K. Vinod and B.K. Mandal.*
- Resources based strategies for fisheries development with special reference to Assam : *S. Purkayastha.*
- Prospects, problems and strategy of freshwater prawn farming in Bihar : *Tun-Tun Singh and Poonam Prakash.*
- Current status of Kyrdemkulai reservoir, Meghalaya and possibilities of its development : *Radha C. Das, Archana Sinha, D.B.L. Kharwanlang, P.S. Tariang and S. Chalam.*
- Ecology and fisheries of Rushikulya estuary of Southern Orissa : *S.K. Das.*
- Soil quality based approach for increasing productivity of fish ponds - a case study : *Abira Banerjee and G.N. Chattopadhyay.*
- Present status of chocolate mahseer, *Neolissocheilus hexagonolepis* (Mc Clelland) in Umiam reservoir, Meghalaya with a note on its conservation : *B.K. Mandal, B.K. Mahapatra and K. Vinod.*
- Composition of freshwater prawn species in and around Ganga river : *D.R. Kanaujia, A.N. Mohanty and Suman Dutta.*
- Carp culture under severe threat from Thai magur (*Clarias gariepinus*) in Punjab and Haryana : *Hardial Singh.*
- Relation of quality fish seed stocking

and fish yield in Adhartal pond : *Praveen Ojha and A.K. Mandloi.*

- *Reservoir fisheries development in Punjab: Problems and development strategies : H.S. Sehgal.*
- Longitudinal models on length and weight of *Puntius sophore* (Mah.) : *Satyabrata Pal, Anurup Majumder, R.A. Gupta, T.K. Basu and C. Medda.*
- Utilisation of seasonal rain-fed tank for composite fish culture : *Ravi Shankar Piska and Jithender Kumar Naik.*
- Resource assessment in the downstream of Ganga river system in respect of certain environmental variables : *Asim Kumar Nath and Samir Banerjee.*
- Status of capture fisheries in Hooghly-Matlah estuarine system and its development strategies : *D.K. De.*
- Emergent need of bioconservation of *Labeo rohita* of North Bihar wetland : *A. Nath, Prakriti Verma, Mridula Sharma and Arun Kumar.*
- Ecological status of production potential of river Narmada : *R.K. Dwivedi, V. Pathak, J.P. Mishra and L.R. Mahavar.*
- Pen culture of Indian major carp fry in two beels of Golaghat district of Assam : *B.K. Goria, V.V. Sugunan and P.K. Saha.*
- Information technology and its potential applications for enhancement of fish production : *D. Karunakaran.*
- Phumdis fishing : Retrospect and prospects in Loktak lake, Manipur : *N.K. Barik and Pradeep K. Katiha.*
- Determining optimum stocking density and predicting fish yield from culture based fisheries in floodplain wetlands (*beels*) of West Bengal : *M.A. Hassan, V.V. Sugunan, G.K. Vinci, K. Mitra and B.K. Bhattacharjya.*
- Possibilities for conservation and development of mahseer in selected reservoirs of Madhya Pradesh : *V.P. Shrivastava, B.L. Pandey and V.R. Desai.*
- Ecosystem oriented approach for fisheries enhancements in reservoirs of south-eastern Rajasthan : *D.K. Kaushal and V.K. Sharma.*
- Prospects of artificial propagation of Indian shad, *Tenualosa ilisha* in the context of proposed impoundments on Narmada river system : *S.N. Singh, R.C. Mandi and S.K. Sarkar.*
- Potentialities of *Channa berca* as a culturable species in wetland environment : *M. Choudhury and S.P. Biswas.*
- Jheels of Uttar Pradesh ~ A potential resource for fisheries development : *Balbir Singh, V. Pathak, L.R. Mahavar and S.K. Srivastava*
- Fish production potential, actual yield and scope for enhancement of production of four medium reservoirs in Tamil Nadu : *V.K. Murugesan, Rani Palaniswamy and S. Manoharan.*
- Spawn availability from river Tons : *B.K. Singh, R.S. Panwar and K. Srivastava.*
- Coldwater fishery resources in Kandi areas of Indo-Gangetic system : *Usha Moza, D.N. Mishra & A. Hazra*
- Abiotic status and primary production of river Narmada on its stretch from Maheswar (M.P.) to Kotiha (Gujarat) : *Dhirendra Kumar, M.P. Singh, D.K. Biswas, Ramji Tiwari and P.N. Jaitly.*
- Fishery of Hooghly-Matlah estuarine ecosystem and its potential : *H.C. Karmakar and S.K. Mandal.*
- Assessment of water quality parameters using IRS-IC data : *R.A. Gupta, S.K. Mandal, D. Nath, D. Kumar, D. Das and S.K. Sahu.*
- Aquacrop production in selected saline wetlands : *Amitabha Ghosh, H.C. Karmakar, A.K. Ghosh, R.N. Mishra, B.B. Das and T. Chatterjee.*
- A study on the east Singhbhum district of Jharkhand ~ its potential in fish production : *Manas Kumar Das, Tapas Kumar Paik and C.R. Das.*
- *Charpata* ~ an efficient fishing method for the riverine and canal fisheries : *Nikhil Narayan Mazumber.*

Session - III : Socio-economic aspects and Institutional arrangements of enhancement

- Knowledge and attitude of members of fishermen Co-operative society towards Trapa-cum-fish farming in Jabalpur Distt. (M.P.) : *Sushant Punekar, L. Oomanchan and N.K. Khare.*
- Training needs of fishery extension officers of Orissa : *S.K. Majhi and H.K. De.*
- Study on the problem perceived by women fishers towards participation in aquaculture activities for upliftment of socio-economic status : *Arpita Sharma.*
- Extension strategies for sustainable yield in aquaculture sector : *A.K. Panigrahi and S.S. Dana.*
- Towards the development of aquaculture in West Bengal: Farmer's perspective : *Sudip K. Datta and Madhumita Mukherjee.*
- Adibashi Mahila Machua Samiti Bastar, Chattisgarh - A case study : *H.K. De, J.K. Jena, S.C. Rath, H.K. Muduli, A.N. Mohanty, K.c. Pani, P. Pattnaik, S. Dey and R.K. Jana.*
- Potential of development of inland fisheries in wetlands : an institutional perspective : *R.S. Shrivastava.*
- Commercial fisheries under different fishing regimes : *Salim Sultan and Mahesh Chauhan.*
- Community-based fish conservation through group activation : *Utpal Bhaumik, S.K. Saha, A. Mitra and T. Paria.*
- Contribution of women in fisheries enhancements in inland waters *Balendra Kr. Das and U.C. Goswami*
- Ecology and fishery management of

impounded waters of Bankura and Purulia districts, West Bengal : *T. Paria and S.K. Konar.*

- Socio-economic traits and fisheries enhancements in oxbow lakes of North Bengal : *M.K. Bandyopadhyay and Pradeep K. Katiha.*
- Upliftment of socio-economic conditions of east Kolkata wetland based population by non-conventional recycling of waste water through pisciculture : *S.D. Ghosh, Sailen Pal, Aloke Mondal and Anirban Ghosh.*
- Role of economic factors in fisheries enhancements in oxbow lakes of Bihar : *Pradeep K. Katiha.*

General Session

In the three concurrent sessions, contents of over 100 contributions listed above were presented and discussed threadbare. Suggestions and recommendations that emerged out of these discussions and the contents of the various presentations made by experts on invitation were considered in the General Session. This Full House undertook a blow-by-blow evaluation of the recommendations made. After deletions, additions, amendments and modifications, the delegates adopted a set of the following 16 recommendations as the ***Barrackpore Declaration***.

Recommendations
(The Barrackpore Declaration)

1) The *Symposium* recognizes rivers, reservoirs, lakes and floodplain wetlands as the most suitable aquatic resources for practising enhancement norms in India. It further identifies enhancement as an important tool in the management of inland fisheries in the country, which ensures eco-friendly development with social equity.

2) It is recommended that the resource inventory, assessment and management of the above resources may be done using tools of GIS and remote sensing, in due collaboration with concerned S&T agencies in the country.

3) The *Symposium* underscores the need for restoration of riverine environment for increased fish production and conservation of endemic fish fauna, which calls for habitat improvement such as breeding and nursery grounds, etc.

4) The *Symposium* identifies water abstraction, wanton killing of brood and juvenile fishes, sand mining, sedimentation due to deforestation, and pollution as the main environmental issues in riverine ecosystem to be tackled on a priority basis and calls for an integrated approach to tackle the issues for involving various stakeholders. Therefore, a National *Riverine Fishery Regulatory Authority* on lines of Aquaculture Authority of India needs to be set up with required budgetary support. The Agency should be fully empowered and equipped to formulate and oversee implementation of riverine fishery development measures, inclusive of regulation of fishing effort, and all other aspects such as sand mining, pollution causing activities etc., which will have an effect on riverine fishery development.

5) The *Symposium* is of the view that reservoirs are to be developed by adopting various enhancement norms. For instance, the small reservoirs are amenable for culture-based fisheries while larger ones are to be developed on the basis of stock and species enhancement.

6) The *Symposium* identifies a need for an institutional mechanism to ensure smooth implementation of enhancement practices for reservoir fisheries development. A Central Sector *Reservoir Fisheries Development Agency* (similar to FFDA) with equal participation from State and Central governments needs to be constituted. It further feels a need to manage the reservoirs on the basis of Reservoir Cluster Wrap (RCW) to ensure timely availability of necessary infrastructure and inputs, for the development of fisheries of the reservoirs coming under each of the wraps constituted. There should be provision for private sector/industry participation in reservoir fishery development.

7) Recognizing an urgent need to enlarge species spectrum of reservoir fisheries, the *Symposium* recommends stocking of prawns and carps other than IMC. Biological investigations on more endemic species are needed to standardize seed production and stock management of these new candidate species.

8) The *Symposium* notes with concern the irrational and destructive fishing practices followed in open waters. Since legal and punitive measures fai. to ensure compliance of various regulations already in force, aggressive campaigns are needed to create the necessary awareness. All research Institutes, in liaison with State government agencies, are exhorted to initiate such campaigns to create awareness among various sections of the public.

9) It is further recommended that sensitization of policy makers, planners and managers on various aspects of enhancement should be taken up on a priority basis.

10) The *Symposium* notes the emerging potentialities for enhancement of sport fisheries in India. It recommends establishment of hatcheries and seed production units separately for sport fisheries in suitable areas. Production enhancement systems should be altitude specific. There should be separate packages for mountain lakes and foothills.

11) The *Symposium* expresses concern on the destruction of city wetlands of East Kolkata. It is recommended that reclamation/ destruction of city wetlands should be stopped to protect the livelihood of thousands of people.

12) The *Symposium* emphasises the need for developing quantitative health assessment methods, which can be

applied for different fish populations in open waters. Appropriate bio-indicators should be standardized for monitoring the health status of fish populations in stressed ecosystems.

13) It is recommended that greater emphasis should be laid on imparting skill development in different enhancement activities to the stakeholders viz., fishers, their children, oustees of reservoirs, cooperatives, etc. for increasing productivity and facilitating rehabilitation.

14) The Symposium recognizes the critical role played by women in *beel* fishery programmes in Assam, West Bengal and Bihar. There should be special drive to educate them and make them aware of the importance of scientific fishery management.

15) Pearl oyster culture, pearl culture, ornamental fish culture, *Tubifex* culture, and crab fattening, etc., are identified as the new developmental vistas for women to pursue in fisheries sector. Therefore, the symposium recommends steps for specific developmental measures in these areas for women.

16) The fisheries education set up in our country should provide adequate focus on skill development at middle level to create entrepreneurship so as to speed up knowledge-based fisheries enhancement.

Natural Organic Farming of Giant Freshwater Prawn

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The authors conducted natural organic farming of *Macrobrachium rosenbergii,* popularly known as giant freshwater prawn, on an experimental basis in a perennial tank of Kagaj Maddur village in Narsapur Mandal of Medak District of Andhra Pradesh. The average waterspread area of this tank is nearly 23 ha and the maximum depth is 8 feet during monsoon period. This tank is under the control of primary fishermen's co-operative society of the above village.

In the experiment, conducted by the authors on behalf of Kakati Aquatech Ltd., and with the help of the members of the said society, seed of the gaint prawn was stocked in the tank on 4 January, 1999. The seed was brought from the hatchery of Kakati Aquatech Ltd, Vijayawada, in Andhra Pradesh. The stocking density was 20,000 nos of seed at PL 15 stage with about 1" length and less than one gram weight. The stocked seed was left to be on their own to feed on natural organic food available in the tank water, which was rich in phyto - and zooplankton and benthos. No supplementary feed was given. No fertilisation either with inorgnic fertilizers or manures was done during the culture period.

Random samples of prawns under culture were collected during July and August and the growth and health conditions were examined. The growth of the prawns was about 17-20 cm in length and 200-250 g weight. During the eleventh month i.e., in November, 1999 the prawns were harvested with cast net, *pondi jal* and also by way of hand picking. The harvested prawns were about 30 cm in length and 420 g weight. The prawn yield from the tank (average area: 22.92 ha) was 1128 kg of 49.21 kg/ha/yr.

Without supplementary feeding and manuring this much of yield of prawns could be obtained. This production is higher than Indian average reservoir fish production (25 kg/ha/yr) (Piska, 1999). We could get this production without much effort and with less of expenditure. This income to the society is estimated at around Rs. one lakh, with the expenditure mostly restricted to the cost of seed and labour.

There are many reservoirs, and long seasonal and perenial tanks in our country. In developing fisheries of these resources not much importance is being given for freshwater prawn rearing in them, although a begining has been made in this direction. If we utilise these water bodies for rearing them, we can get an impressive yield of prawns which can fetch higher income as they have export value and are now being increasingly exported. Prawns can be cultured independently (Monoculture) or along with carps (Polyculture) in these water bodies. Through adoption of polyculture and augmenting seed stocking levels to a maximum sustainable level, and in an environment friendly manner, it should be possible for farmers to obtain higher yields without incurring heavy expenditure, and substantial incomes.

Reference

PISKA RAVI SHANKAR (1999) *Fisheries and Aquaculture,* Lahari publication.

Two Fellowships conferred on ABIDI

The fellowship of Inland Fisheries Society of India was conferred on Dr. S.A.H. Abidi, renowned Fishery Scientist and currently Member, Agricultural Scientists Recruitment Board, New Delhi on 27.4.02 at Kolkatta in recognition to his contribution for research and development of Fisheries and Aquatic Ecology in the country.

The Fishery Technology Society of India has also conferred honorary Fellowship on Dr. S.A.H. Abidi for his contribution in the development of fisheries and aquaculture management system.

Blowfly Infestation among Cured Fish in A.P and Orissa Control Strategy Studies under DFID Project

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Blowfly infestation is a serious problem in traditionally cured fish in tropical developing countries including India. On the east coast of India, traditonal fish processing continues to be a very important livelihood activity especially for poor women; profit margins are low and the working capital for each processing cycle must come from the sale income of the processed dry fish. Blowfly infestation, particularly during the monsoon period, can result in considerable losses and unleash disastrous consequences for the processors.

Despite extensive research and promotion of blowfly control techniques e.g., pirimiphos - methyl application, use of solar dryers etc., over the past 30 years, the uptake of recommended control measures by fish processors has been poor and so insect infestation of traditionally processed fish continues to remain a major cause of physical, nutritional and economic losses. The failure in suc-

Fig 1. A traditional fish processing site in Andhra Pradesh ~ unhygienic surroundings like this help in the proliferation of blowfly populations

Fig 2. Blowflies feasting on exposed fish flesh

Fig 3. Blowflies on twigs in the vicinity of fish processing

Fig 4. The most common blowfly affecting fish in tropical countries - *Chrysomya* spp

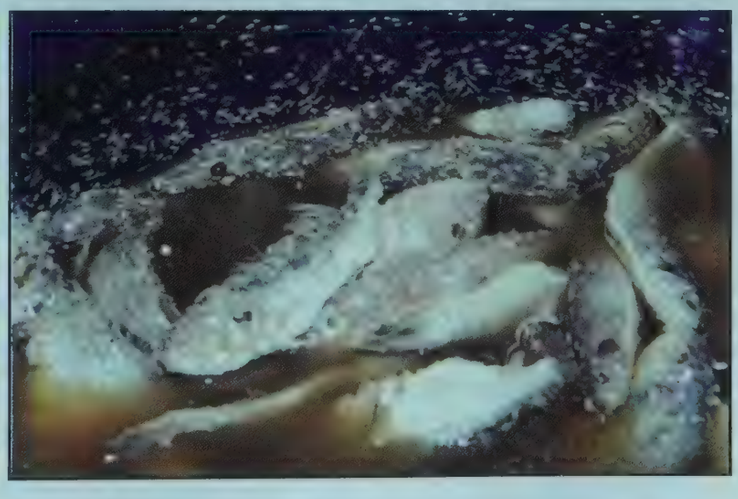

Fig 5. Maggots floating on the surface of the brine

Fig 6. Blowfly egg clusters on fish gills

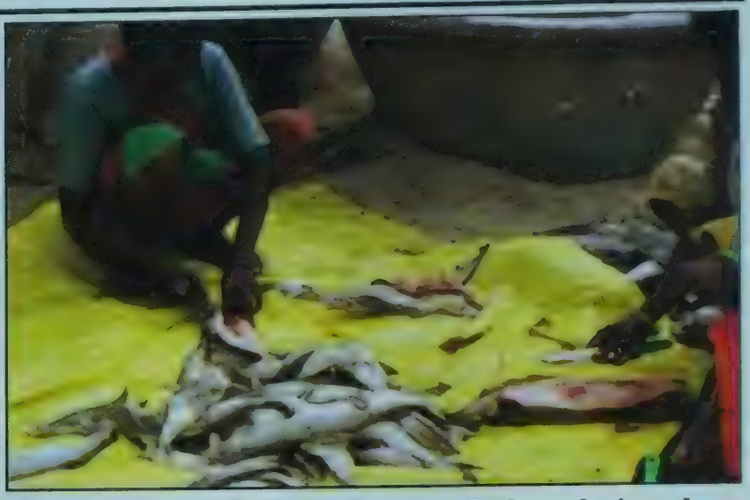

Fig 7. Using a plastic sheet and clean knives has been found to give good results

Fig 8. The bamboo wooden tray is used to hold the fish down in brine in order that blowflies cannot reach the fish and lay eggs on them

Fig 9. The bamboo tray and wooden lid being used by a processor in Visakhapatnam, A.P.

Fig 10. The two-piece wooden tray is easier to handle and does not expose fish to undue infestation

Fig 11. Arranging fish for drying on the rack ensures a cleaner product, and safety from insects and dogs

cessfully promoting recommended control measures is attributed to three factors:

- Technical difficulties inherent in the technique itself.
- Socio-economic constraints, whereby implementation of the suggested measures may be either too costly or culturally unacceptable or both, and
- Poor extension of research findings to the fish processors.

A more serious shortcoming may be that traditional fish processing operations are never homogeneous. Even within the same village, different proces

sors use different regimes for processing which is either in accordance with the preferences of the particular set of cnsumers or is determined by the features of the area where processing takes place e.g., access to salt, water, availability of space etc. The heterogeneity of small-scale fish processing operations complicates the identification and promotion of simple, transferable solutions to blowfly infestation.

It is thus clear that a reduction in insect infestation of traditionally processed fish may only be achieved by developing a systematic and holistic control strategy that is adaptable to the many different fish processing systems and takes into account the limiting socio-economic factors.

The UK Government's Department for International Development supports a Post-Harvest Fisheries Research Programme (PHFRP) whose main aim is to fill in the gaps in our knowledge and understanding of the lives and the livelihood activities of post-harvest workers in order to provide need-based and effective policy guidance to agencies working with the coastal poor.

Research work undertaken by the authors recently is based on the premise that the success of any measures to control blowfly would depend upon a detailed understanding of the various processing methods adopted, the different modes of infestation and, the influence of external factors, such as climatic variations, fish species processed, processing practices followed and insect species present and, on infestation patterns and levels. In other words, the success of the measures taken, related to the identification of the 'Critical Control Points' in the processing chain, will enable the formulation of suitable preventive measures to be taken at appropriate stages. As part of the work, information relating to the variables concerning insect infestation is collected, and their importance in influencing infestation patterns is determined. The data arising from this research has been used for the development of a 'Prototype Systems based Blowfly Control Strategy' that offers fish processors a flexible and sustainable way of controlling blowfly infestation.

In the systems-based strategy, the control methods are derived organically from within a processing chain and hence they do not mean changing all stages in a processing system radically to suit a method, something that the processors are loathe to do. Being case-specific, it also enables individual processors to adopt suitable methodologies without necessarily going in for a uniform solution. Once the approach is systematised, any field-level extension worker should be able to work out the 'Critical Control Points' participatorily with processors and develop acceptable remedies that are appropriate to individual situations. The processor is thus enabled to select only those materials and methods that suit both the purpose and their purse.

This paper provides an overview of a field evaluation of the systems- based strategy being conducted in Andhra Pradesh and Orissa States in India under DFID's Post-Harvest Fisheries Research Programme. The research team consists of the representatives of the Department of Fisheries (Andhra Pradesh), Integrated Coastal Management and Mike Dillon Associates Ltd. The project began in April 2001, and is due to run until December 2002, when the strategy will be disseminated at a final workshop.

Along side the field evaluation, the research also aims to develop a socio-economic appraisal of the current situation and the economic implications of change, and also options for further development and evaluation of training and extension materials. The project purpose is thus, 'to complete the development of a prototype blowfly control strategy that is appropriate for use by resource poor fish processors across the tropics, and produce related training/ extension materials. Field evaluation and cost-benefit analysis data will enable the strategy to be modified to meet the needs of resource poor fish processors. Once completed, it is believed the strategy will offer a viable alternative to the use of insecticides to control blowfly infestation of traditionally cured fish.

Field trials in monsoon period have so far been conducted at two fish processing sites — Uppada in Andhra Pradesh and Paradeep in Orissa. A dry season trial was conducted at Timmapuram village near Visakhapatnam to obtain a comparison in the levels of infestation between monsoon and non-monsoon periods. The last phase of the trials is to be conducted during June-September 2002 in Andhra Pradesh at Uppada and Timmapuram simultaneously and this will run through the entire monsoon period.

The trials are intended to test the hypothesis that the systems-based blowfly infestation control strategy provides a cost-efficient, technically effective and socially acceptable remedy to blowfly infestation of traditonally processed fish during processing and early storage. The emphasis has been on ensuring the full participation of the processors in the project activities.

Following collection of background socio-economic data, an infestation audit was conducted at each of the processing sites and infestation points identified. In that light, certain interventions were then agreed to with the processors.

During the course of the trials, Six of the interventions out of those agreed to were selected by the processors pursued during the trials.

1) Speeding up the process of procurement of fish and the pre-salting stages, i.e., gutting, splitting, de-scaling etc.

2) Using clean plastic sheet for keeping the fish on, during the pre-salting stages.

3) Using good quality salt for production of brine, and complete change of brine after every few cycles.

4) Holding the fish in brine with the help of a bamboo frame, and with salt bags for weight.

5) Using a waterproof lid to control blowflies and water inflow inside the salting vats. Where the vats have jagged edges, a cement coating was given to the rim of the vats. The lid used for the purpose during trials was made of wood, and,

6) Drying the fish above ground level on simple drying racks.

The interventions remained more or

less the same in all the three field sites. Intervention costs have not exceeded Rs. 2,000 in the trials conducted so far.

Data collected during the monsoon period field trials show real benefits associated with the adoption of the interventions selected by the processors. Infestation and loss levels experienced by processors using the interventions have been consistently lower than those experienced by the other processors. Reductions in infestation and losses have been translated into economic benefits. In Uppada, other processors together made a profit of 7% on the total costs they incurred, while the processors who adopted the improved system recorded a profit of 18%. In the second set of trials in Paradeep, Orissa, the contrast was even greater. The other (control) processors made a loss of 2%, while the experimental group made a profit of 11%. In both locations the results are highly consistent; on each of the four processing cycles monitored at each location the experimental processors achieved clearly better profit levels. It is encouraging to report that the processors have continued to use the interventions long after the withdrawal of the project team from the field trial sites.

As already mentioned, the project will come to an end by December 2002, and it is envisaged that by then it will yield the following outputs:

- A refined strategy for limiting blowfly related losses in traditionally processed fish, that is flexible in its application, allows for seasonal variation and offers fish processors a choice of control measures to suit their individual social and economic requirements.
- A cost-benefit analysis of implementing the various control measures contained in the strategy, drawing comparisons between conditions of heavy blowfly related losses and when losses are negligible, and extrapolating the cost-benefit over the year.
- Fully illustrated and updated manual of best processing practice.
- A training pack illustrating the biology and control of blowfly infestation and implementation of the systems-based blowfly control strategy to equip trainers.

The primary beneficiaries of the project work will be obviously fishing communities, more particularly fish processors and traders and consumers of traditionally processed fish. Fishing communities and fish processors will have a flexible blowfly control system available, a system that meets their individual social and economic needs and gives them greater control over their fish processing enterprises. Where insecticides are currently used as a control measure, processors, their families and consumers of the treated fish will benefit from reduced exposure to harmful chemicals. Where control measures are not used, or are ineffective, processors will benefit from reduced fish losses and thereby having improved economic security. Consumers will benefit from increased availability of, and access to, traditionally processed fish. In addition, the capacity of the local officers of the Department of Fisheries and the NGOs to effectively deal with problems experienced by the traditional fish-processing sector will be strengthened.

Acknowledgements

The authors gratefully acknowledge the active support and encouragement provided by the Department of Fisheries, Government of Andhra Pradesh, and most particularly by the Commissioner of Fisheries, Mr D. S. Murthy.

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65-day fishing ban along Kerala Coast

The Central Government's gave a directive to impose a 65-day ban on sea fishing along the west coast from June 10 to August 15. While this may be a hardship to fishers working on mechanised fishing boats in the State, it may in all probablity gladden the hearts of the traditonal fishermen who have been demanding the banning of trawling for three moinths from June on the ground that they constitute the fish spawning season.

The Centre's proposed ban has not only raised the number of ban days to 65 (from the conventional 45 days), but also has imposed a blanket ban on all forms of fishing, not just deep-sea trawling.

According to Mr. K.V. Thomas, Fisheries Minister of Kerala, the ban would affect the entire sea fishing sector. The ban might ignore traditional fishing, he said, adding that since sea fishing is mostly mechansied in Kerala, the impact would be widespread.

Prof. Thomas said, though the Government favoured a ban for a reduced number of days, there were certain practical problems. He said that the ban applied to all the States on the West Coast (Maharashtra, Gujarat, Goa, Karnataka and Kerala). If any one of these States reduced the number of ban days, fishermen from other States would rush to that State and it would be to its disadvantage.

He observed that the ban directive was the outcome of a meeting of the officials from the West coast States in Mangalore in 1998. The States had agreed on the period of ban. It was a collective decision and it would be difficult for Kerala to back out, he said.

The minister K.V. Thomas told the State Assembly on 25 June that the government was examining whether a total fishing ban for two months could be enforced during the monsoon, as suggested by the Centre, from next year.

He also said that talks were being held with fishermen's organisations and others concerned in this regard, he said while replying to questions.

On a member's demand to supply free ration to the fisher families during the trawling ban, he said a saving-cum-relief scheme was in force to provide assistance during the period. Two instalments of the assistance had been disbursed and Rs.8 crore had been set apart for the payment of the remaining two instalments.

Pearl Culture in India : Techniques, Status and Prospects

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Pearl, being an object of great value, has always symbolised love and feminine charm in the various societies around the globe. Among the different species of marine molluscs found in the different regions of the world, the pearl oyster belonging to the genus *Pinctada* is the most highly priced and sought after. Occurring in almost all the seas of the tropical and subtropical belt, it inhabits the sea bottom from the low tide level to a depth of 80 mts. Of the various species of pearl oysters, only three species have been found to produce pearls of gem quality and have commercial value. These are : *Pinctada fucata* (Gould), *Pinctada margaritifera* (Linnaeus) and *Pinctada maxima* (Jameson). With the turn of the last century the demand for pearls increased but the supplies from existing fishing grounds diminished rapidly owing to over-exploitation and pollution. This initiated tremendous research attention with support from both State and trade sectors all the world over, leading to the evolution of pearl culture technology as a thriving enterprise in many parts of the world including India.

Species and Distribution

Around six species of pearl oysters occur in the waters of the Indian coast namely, *Pintada fucata* (Gould), *P. margaritifera* (Linnaeus), *P. chemnitzii* (Phillipi), *P. sugillata* (Reeve), *P. animoides*, and *P. atropurpurea* (Dunku). Among them *P. fucata*, better known as the Indian Pearl Oyster, is the most dominant and contributes to the pearl fishery of the Gulf of Mannar and the Gulf of Kutch. The natural pearls harvested from the pearl oysters of these two water bodies are held in high esteem in all the world markets and are popularly called "Orient Pearls". The pearl banks in the Gulf of Mannar region are known as "Paars" and those in the Gulf of Kutch region as "Khaddas". The last natural pearl fishery exploitation in these regions were held in 1961 and 1967 respectively (James and Narasimham, 1993). Other than these two regions, spat of *P. fucata* has been collected from the Vizhinjam area on the South West coast of India. *P. margaritifera* is mostly confined to the Andaman and Nicobar islands, although stray collections were made along the Vizhinjam and Gulf of Mannar coasts also. The famous "Steel Black Pearls" are produced from this species.

Mariculture

Spat Collection **:** For running a pearl culture farm, a steady supply of pearl oyster seed is a pre-requisite. Collection of pearl oysters from the natural beds is not always dependable, owing to their irregular production. There are three ways to raise pearl oyster spat for grow-out operation:a)Setting up of artificial spat collectors at sub-surface during oyster spawning season:b)Collection from natural beds, and c)Hatchery production of seeds.

Artificial Spat Collectiors: In setting up of artificial spat collectors, the best way is to provide the right type of them at the most propitious time, especially during the peak spawning season in the farm area for the attachment of spat in large numbers. This will prevent the spat collector from being fouled with barnacles and other organisms. There are several practices for spat collection in different parts of the world. In France, lime coated semi-cylindrical ceramic tiles are used. In Japan, materials easily available such as bamboo, twigs, tiles, shells of molluscs, pebbles etc., (Imai, 1970) are used. On the east coast of U.S. and along the Gulf of Mexico, strings of scallop shells are mainly used (Iverson, 1968).

In India, commonly available materials such as pearl oyster shells, rope collectors, synthetic filamentous spindle, split bamboo collectors and coconut shell collectors are used for spat colection (Victor *et al.*, 1987).

Collection from Natural Beds: In India pearl oyster beds are located along the Gulf of Mannar and Gulf of Kutch coasts. In the Gulf of Mannar, pearl oysters occur in large numbers on the *Paars*. The *paars* lie at depths of 12-25m off the Tuticorin coast along a stretch of 70 km (Victor and Velayudhan, 1996). The extent of these *paars* varies from a few hectares to several square kilometers. Pearl oysters from these beds are collected by skin divers and scuba drivers. In the Gulf of Kutch, the pearl oysters are found sporadically on the inter-tidal reefs known as "Khaddas". Collection of oysters is done by hand picking.

Hatchery Production of spat: Hatchery production of spat is much more reliable since it ensures a sustained source of seed for culture throughout the year. In a hatchery system, site selection, hatchery building, water management, aeration, larval food production, broodstock maintenance, larval rearing system, disease control of larvae are important factors for effective management (Alargarswami *et al.*, 1987). In India, the Central Marine Fisheries Research Institute, has produced excellent results from their hatchery operations.

The oysters obtained from the three sources mentioned above are cleaned and placed in cages and hung vertically in the sea from the raft/rack at desirable depts.

Growout Operation: Site selection is

one of the most important factors to be taken into consideration for pearl oyster farming. Areas sheltered from strong winds and waves are generally preferred. Hard and gravelly sea bottom is ideal. Sea bottom which is muddy should be avoided as suspended silt is harmful to pearl oysters.

Factors such as continuous water flow, primary productivity, predators, pollution, strong currents etc., need to be given due consideration. The pH should be in the range of 7-8. The composition of trace elements in the sea water is vital as the colour of the pearl is influenced by it. Also calcium, which is the basic element required for the formation of the shell and pearl is an important requisite since lower levels of the element leads to formation of thin shells and/or low quality pearls.

There are different systems for the culture of pearl oysters out of which the *raft* and *rack* are the most widely used in India.

Raft is more suitable and commonly used in sheltered bays were the depth is 5m or more. *Raft* culture employs rigid floating platforms which are moored. The platform is constructed by placing wooden poles parallel and across and tied with a coir rope to make a rigid frame. The *raft* is floated by four empty airtight barrels. The size of the raft varies, although 6 x 5m rafts are considered ideal. On these rafts the holding capacity is 100cages (Chellam *et al.*, 1987).

Rack culture is practised in waters with low depth i.e., less than 5m. *Rack* is a fixed structure comprising several wooden poles driven into the sea bottom over which a wooden frame is made at a height of 0.5m above the water level so that the rack thus erected remains always above the water. The overall size of the rack is 10m x 10 m. A total of 400 box type cages can be suspended from the frames.

The juvenile oysters are reared in net cages. The cages are constructed out of a frame made of 6mm steel rod with 35 cm sides in the form of a prism. All sides of the cages are encased in synthetic fabric of velon screen with the mesh size depending on the size of the spat reared.

The box cages of size 40x40x10cm with a lid and meshed with 2mm synthetic twine are used to rear mother pearl oysters and nucleated oysters. A box cage can hold 125 oysters of 35-45 mm size, 100 of 45-55 mm size, 75 of 55-60 mm size and about 50 in the case of larger oysters (Victor and Velayudhan, 1996).

Other culture methods like long lines (with a series of large hollow floats in a row attached to strong ropes and anchored) are also suitable. Long lines are advantageous in that they are flexible and can withstand rough sea conditions far better than raft and racks. The other common methods used in pearl oyster culture are under water platforms erected at a depth of 40ft (Aquacop, 1982) 'used in the deep lagoons especially in the island of French Polynesia' and in the on-bottom culture used in Mediterranean countries.

Management and Maintenance of Farm

Predators, bio-foulers and boring organisms pose a threat to the culture operation. Therefore great care and attention for the management of the site is needed.

Fishes such a *Serranus, Balistes* and *Lethrinus,* rays, starfishes and octopus are the common ones that predate on pearl oysters in their natural beds (Dharmaraj *et al.*, 1987). While in farm conditions they have not caused much damage, predatory fishes and gastropods however are said to cause minor damages in the culture site. They compete for food, make the shell heavier and disrupt the shell movement. The barnacle *Balanus amphitrite,* bryozoans such as *Membranipora, Legenipora* and *Thalamoporella,* simple ascidians such as *Ascidia* and *Dicarpa* and also molluscs such as *Aviculla* and *Crassostrea* are the major foulers of pearl oysters. Biofouling of pearl oysters and their rearing cages constitute a major problem.

Boring organsms like sponges *(Clionata celata, C. vastifica, C. margaritifera)* and polychaete worms belonging to the family Syllinidae, Nereidae, Spionidae, Terebellidae, and Cirratulidae, bore the oyster shells. Among the polychaete worms, *Polydora ciliata* and *P. flava* belonging to the family Spionidae and *Cirratulus cirratus* belonging to the family Cirratulidae are the common borers. The Pholadid mollusc *Martesta* spp., and the Mytilid *Lithophaga* spp., and the Isopod, *Sphaeroma* spp., occasionally appear and bore the oyster shells, although to a lesser extent.

Pearl Culture Technology

The production of cultured pearls involves selection of oysters, production of shell bead nuclei, surgery and post harvest technology. Healthy oysters of size 45 mm and above are usually selected (Sasi Nayar *et al.*, 1997). Oysters in inactive and resting reproductive phase are also suitable for the purpose, since in the ripe oyster the gametes in the gonad interfere with the operation.

The principal causative factor for the formation of pearl in an oyster is the presence of a nucleus. Under natural conditions these particles may enter the oyster when the oyster opens its valves for feeding and respiration. In artificially induced pearl production a spherical bead of shell nucleus together with a piece of mantle tissue is implanted into the gonads of mature oysters. The laboratory phase is very short and involves the selection of oysters, conditioning, graft tissue preparation, nucleus, surgery and convalescence.

***Selection of Oysters*:** The factors to be considered in the selection of oysters are the age, weight, stage of sexual maturity and overall health. Oysters of 25g weight and above (1.5 to 2 yrs) are ideal and even smaller sizes are considered for implanting smaller nuclei of 2-3 mm diameter (Victor and Velayudhan, 1996). The gonad of the oyster should be in the spent resting stage. Ripe ones are not suitable, since during surgery the gametes tend to flow out and block the visibility of the implantation site so that proper orientation of the mantle piece and nucleus can-

not be ensured.

Conditioning **:** The selected oysters are conditioned for nucleus implantation. Preconditioning of oysters for surgery is an essential process. Healthy oysters, when taken outside sea water close their valves tightly by contracting the adductor muscles. For surgery a gap of 1 - 1.5 cm between the valves is required. When the valves of the oysters are opened forcefully their adductor muscles get cut and the oysters die immediately. Hence the oysters are allowed to open their valves gently by themselves.

Graft Tissue Preparation : This is an important stage in surgery. Many graft tissues can be prepared from the mantle of a single oyster. A healthy oyster is taken from the stock and a sharp knife is inserted between the two valves up to the adductor muscle and the latter is cut vertically. The knife is pushed further down so as to cut the soft body into two. Using a pair of scissors a strip of 5cm long and 0.5cm wide mantle is cut and transferred onto a rectangular soft wooden block. The mucous of the mantle is removed with the blunt end of a scalpel. The thickened outer edge and the inner muscular portion of the mantle is cut and removed. Mantle from both sides is used in the preparation of graft tissues. The graft tissues should be kept with sterilised filtered seawater during the preparation. Care should be taken to see that the graft tissues are used within 15minutes of preparation.

Nucleus **:** The presence of an alien body elicits a response in the oyster and the foreign body is invaginated by the outer epithelium of the mantle resulting in the formation of a pearl sac around the nucleus. The pearl sac which is derived from the internal or external layer of the epithelium of the mantle or the gill plates has epithelial cells that secrete nacre which gets deposited over the nucleus in layers imparting a lustrous look.

Harvesting and Grading

The process of harvesting is usually performed manually. Pearls are usually extracted by separating the two valves, making an incision on the gonad and squeezing the pearl out. The harvested pearls are then washed with water and acid free soap and dried before sorting.

The quality of cultured pearls depends upon the thickness of the nacre, iridescence, lustre, colour, size and flaws. After harvest they are graded into three categories.

Class A: Flawless/ One Flaw/ Small Flaws/ Small Stain/ Pink, Silver or Light Cream

Class B: Large Flaws/ Stains/ Cream Colour/ Shape Irregular

Class C: Trash Pearls/ Wild Shape/ Clayey Lumps etc.

The rejected or trash pearls are used in the pharmaceutical industry or for the recovery of the nuclei. The visceral meat and the crushed oyster shell are commonly used as poultry feed. The shell can also be marketed as a curio or ornamental item. The adductor muscle of the pearl oyster is used in making delicious food.

Status

Pearl culture in India is presently being pursued by the Central Marine Fisheries Research Institute at Vizhinjam on the West coast and at Tuticorin and Mandapam along the Gulf of Mannar. Research and Development in the field of pearl oyster feeds are being carried out at the Visakhapatnam Regional Centre of CMFRI, tissue culture of pearl oyster at the Tuticorin Centre and remarkable progress has been achieved in the seed production of *Haliotis* and the organ culture of Abalone mantle tissue at the Mandapam Centre. National Bank for Agriculture and Rural Development (NABARD) has made inroads into this field on the East Coast of India (Sasi Nayar *et al.*, 1997). The Tamilnadu Fisheries Development Corporation has been practising rack culture near Krusadai Islands in Rameshwaram (James and Narasimham, 1993). A few other private institutions are also involved in the production of marine and freshwater pearls. Published statistics on the pearl production are not available either in the FAO Fisheries Statistics data or at the National level.

Problems and Prospects

Pearl fisheries of India in the Gulf of Mannar and Gulf of Kutch have been well known for the production of the finest of natural pearls. Both are based on the species *P. fucata*. Major problem with these resources is the wide fluctuation in the production from natural beds. Resources of such nature cannot be depended upon in pearl culture for which the supply of oysters has to be on time and in required numbers.

A second species of pearl oyster, *P. margaritifera* has recently been suggested as a potential candidate species for pearl culture in India based on the indicative survey on mariculture potential of the Andaman and Nicobar islands carried out by CMFRI (Alagarswami, 1983). However, this species does not occur along the mainland coast in any appreciable numbers.

Spat collection from the natural beds of Gulf of Mannar is logistically difficult in terms of distance, depth, accessibility and security and no meaningful effort has been made so far. Spat settlement in inshore areas has been moderate but it is composed of multi-species *Pinctada* populations with a progressively declining *fucata* component as seen at Vizhinjam (Achari, 1982) and Tuticorin (Alagarswami, 1977) Centres. The general conclusion that arises from research work conducted so far is that natural spat collection would not be of much use in pearl culture.

Areas subject to monsoon, typhoon and cyclone have to pay a very high price in maintaining the structures related to pearl culture in open sea. Countries which have ideal locations along their coast in the bays and lagoons, carry out pearl oyster farming without any major problems as in Japan, Australia and Philippines. Along the Indian coast an area which affords a tolerable sea condition is the Gulf of Mannar where pearl culture is flourishing. The Andaman & Nicobar

and Lakshdweep islands offer better scope and conditions for pearl culture and the future of pearl farming appears to lie in these islands. Indian expertise in the field of pearl culture is highly commendable and technical knowledge in this field is sought after by many foreign institutions.

Tangible strides have to be made in the area of indigenous production of shell bead nuclei. Modern systems and materials may replace the structures used in farms. Maintenance of a breeding reserve of pearl oysters in the Gulf of Mannar is a viable alternative for the natural collection of spat. Simple and cost-effective methods have to be developed to control fouling and boring organisms. Sea ranching of pearl oysters from hatchery to natural beds will help in reviving the pearl oyster population to a great extent. Identification of new sites and research and development of the existing technologies have to be given higher priority.

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Two Seafood Export Parks to be set up in Kerala State

The Government of Kerala proposes to set up two seafood export parks in the State, one each in the Cherthala-Aroor and Palluruthy Munambam belts, to provide state-of-the-art facilities for the marine products export units in the zones. The move follows a recent Union Commerce Ministry's decision to provide funds to the State Government for export promotion under the scheme 'Assistance to State for Infrastructure Development and Exports (ASIDE)'.

An Expert Committee headed by MPEDA's Chairman Mr. Jose Cyriac, has also been formed to finalise and pursue the issue with the Commerce Ministry officials.

The Committee, which met recently, also asked Dr. D.D. Namboothiri, Dean, Fisheries College, Panangad to prepare a detailed project report on the seafood export parks. An expert team comprising Matsyafed's Managing Director, Prof. Tinku Biswal and others were expected to finalise the report before forwarding it to the Commerce Ministry.

The setting up of export parks, in the two regions, where concentration of seafood export units is the highest in the State, will help to improve the facilities in the units.

A large portion of the funds are expected to be utilised to improve infrastructure facilities of the two zones such as those relating to construction of roads, setting up of effluent treatment plants, providing high quality power and water supply, among other things.

Under the ASIDE scheme announced by the Commerce Ministry, 80 per cent of the funds will be given to the State Governments to promote exports by creating appropriate export infrastructure and by providing facilitation for export promotion.

The Ministry will also sanction the remaining 20 per cent of the funds once the project takes off, it is learnt.

It is felt that there is much scope to improve the Munambam harbour and the landing stations like Kamalakadavu and once the project gets the Centre's nod, these can be developed as part of the export park project.

Esteemed Readers!

Let others also know about any interesting developments in fisheries sector you reliably come to know of, particularly when they are important and encouraging. Kindly pass on the news to : *Fishing Chimes*, Sector 12, Plot 176, M.V.P. Colony, Visakhapatnam - 530 017. Tel : 0891-543171, 539319; Fax : 539142; Email : fishingbells@satyammail.com

Quality Improvement of Sun-dried *Acetes indicus* (*Jawala* Prawn) by Radiation Processing

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A radiation processing method for the preservation of sun-dried ***Acetes indicus*** *(Jawala prawn) was developed. Sun-dried Jawala prawns were subjected to gamma radiation at a dose of 1 and 2.5 kGy and stored at ambient temperature (26° C). During the course of storage, quality of the product was assessed in terms of total bacterial count, mould count and biochemical indices, namely total volatile basic nitrogen (TVBN) and trimethylamine (TMA). The dried jawala had an initial bacterial load of 3.5 x 10^5 cfu/g. Although TBC was not immediately affected by irradiation at a dose of 2.5 kGy, during storage for two months, TBC was reduced to 1.5 x 10^3. Irradiation suppressed the formation of TVBN and TMA during storage. The results suggested that a radiation dose of 2.5 kGY was suitable for preventing quality deterioration due to microbial and mould growth for four months.*

Non-penaeid prawns constitute one of the important conponents of marine fishery resources of India. They account for 65% of marine prawn production of the country (Deshmukh, 1993). Annual landing of non-penaeid prawns during the year 1998 stood at 1,74,000 tonnes, and a major portion of these were caught along the coast of Maharashtra and Gujarat (MPEDA, 1999). Non-penaeids comprise three major species viz. *Acetes indicus* (locally known in Maharashtra as *Jawala*), *Palaemon tenuipes* (Karadi or Ambar) and *Hypolismata ensirotris*. Out of the fishery of these three species, 65% is contributed by *Acetes indicus* (Nambiar *et al.*, 1988). It is a tiny prawn covered with a chitinous shell and size ranges between 2 to 4 cm and removing its shell is practically impossible. On account of this, the entire catch is sun-dried on sandy beaches. The product usually has relatively poor appearance and is often mixed with large amounts of sand and other extraneous matter picked up during drying (Garg *et al.*, 1977). Due to lack of proper hygiene and sanitary conditions at the drying yards, the finished product is often contaminated with microorganisms. *Jawala*, often packed in gunny bags, when kept so packed for more than a month, undergoes discolouration due to browning. A market survey conducted by Valsan *et al.*, (1985) on the quality of dry non-penaeid prawn of Bombay market had clearly indicated the need for strict quality control measures and improved packaging. Considering the trade in large quantities of dried *Jawala*, it was felt necessary to develop a suitable method to improve the quality and extend its shelf life. Radiation processing of semi-dried fishery products is known to prevent infestation and also reduce bacterial contamination resulting in their quality improvement and extension of shelf life (Vinh *et al.*, 1996; Kwon *et al.*, 1993; Venugopal *et al.*, 1999; Warrier *et al.*, 2001). Radiation processing of fishery products has been thoroughly and extensively studied in order to ensure its toxicological, nutritional and microbiological safety (Venugopal *et al.*, 1999). The present study was carried out to examine the efficacy of radiation processing of semi-dried *Jawala*.

Materials and Methods

Fresh sun-dried *Jawala* were obtained from Trombay harbour, Mumbai. The foreign matters such as small fishes, broken pieces of shells, stones, sand etc., were manually removed from the sample. The product was packed in 100 g quantities in 700 guage polyethylene bags. One set of packets was maintained at 26° C without gamma radiation treatment which served as control, while two other sets were exposed to gamma radiation doses of 1.0 and 2.5 kGy at ambient temperature in a ^{60}Co Food Package irradiator (Atomic Energy of Canada Ltd., dose rate, 0.05 kGy/min). After radiation treatment, unirradiated and radiation processed packets containing *Jawala* prawns were stored at ambient temperature (26° C). At periodic intervals, samples were withdrawn and the quality evaluation was carried out.

Proximate Composition

Nitrogen was determined by Kjeldahl digestion of *Jawala* followed by Nesslerization (AOAC, 1990) and the protein content was calculated (N x 6.25). For the determination of total lipids, known amount of finely powdered *Jawala* was refluxed in petroleum ether for a period of 16 h in Soxhlet apparatus. The ether extract was evaporated in a water bath and dried to a constant weight at 105° C for the determination of total lipids (AOAC, 1990). Moisture and ash contents were determined by standard methods (AOAC, 1990).

Total Bacterial Count

A 10% homogenate of *Jawala* was prepared in 0.9% sterile saline and appropriate serial dilutions were plated on plate count agar for determining total bacterial count (TBC). Potato dextrose agar was used for fungal count by spread plate method. For TBC the plates were incubated at 37° C and for fungal count plates were incubated at 30° C for 48 h before counting the colonies as per standard methods (AOAC, 1990).

Biochemical Indices

Total volatile basic nitrogen (TVBN) sestimated from an extract of 10% (w/v) in water of *Jawala* homogenate mixed with an equal volume of 10% (w/v) aque-

ous trichloroacetic acid (TCA) by Conway microdiffusion technique (Faber & Ferrow, 1956). Trimethylamine nitrogen (TMAN) was determined from the TCA extract by Dyer's method (Dyer, 1945). Non-protein nitrogen was also determined from TCA extract (AOAC, 1990). Alkaline proteinase activity of dry *Jawala* was estimated from a 10% extract prepared in 0.2 M KCl as described by Sherekar *et al.* (1997).

Results and Discussion

Fresh sun dried *Jawala* contains 59.53% protein, 5.14% total lipids, 21.69% moisture and 9.28% ash (Table I). There was no significant change in the proximate composition of both unirradiated and radiation processed *Jawala* prawns during storage. However, non-protein nitrogen in control as well as radiation processed samples increased from 4.0 to 5.0 g/100g tissue during 4 months of storage at ambient temperature. Initial microbial count of sun-dried Jawala prawn was 3.5×10^5 cfu/g (Table 2). Immediately after radiation processing the total bacterial count in 1.0 and 2.5 kGy radiation processed *Jawala* prawns were 2.6×10^5 and 5.0×10^5 cfu/g respectively. After 2 months storage there was no change in TBC of unirradiated *Jawala* whereas 1.0 and 2.5 kGy radiation processed *Jawala* showed TBC of 1.0×10^4 and 1.5×10^3 cfu/g respectively. However, after 2 months of storage, control as well as 1.0 kGy radiation processed samples showed cake formation due to mould growth and spoilage. As against this, there was no mould growth in 2.5 kGy radiation processed *Jawala* even after 4 months of storage at ambient temperature. Thus it is evident that a dose of 2.5 kGy is effective in preventing microbial deterioration of packed sun-dried *Jawala* prawns for 4 months without any mould growth. Known *et al.*, (1993) have shown that a radiation dose of 5.0 kGy is necessary to prevent microbiological deterioration of packed boiled dried Korean anchovies for 6 months without any mould growth.

Table I. Proximate composition of sun-dried *Jawala* prawns

Constituents	%
Protein (N x 6.25)	59.53 ± 1.61
Total lipids	5.14 ± 0.16
Moisture	21.69 ± 0.26
Ash	9.28 ± 0.32

Values are average of four independent estimations

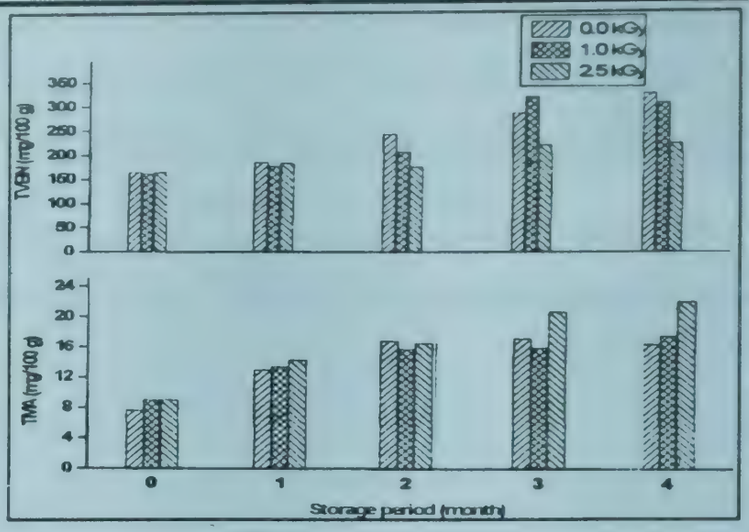

Fig 1. TVBN and TMA levels of radiation processed and unirradiated sun-dried *Jawala* prawns.
Values are average of three independent experiments

Sun-dried *Jawala* showed an initial TVBN value of 163.5 mg/100 g tissue (Fig. 1). In control as well as 1.0 and 2.5 kGy radiation processed samples there was a steady increase in TVBN value during storage, the increase being less in radiation processed sample. After 2 months of storage control, *Jawala* showed a TVBN value of 243.5% mg/100g tissue as against 175.3 mg/100g tissue in case of radiation processed (2.5 kGy) sample. This observation is in agreement with Vinh *et al.*, (1996) who have reported steady increase in TVBN value in a variety of semi-dried fishery products during storage. They have shown that TVBN value in semi-dried shrimp (*Penaeus indicus*) had increased to 246 mg/g tissue in 2 months storage at ambient temperature. Similar increases in TVBN value were also observed in the case of semi-dried Vietnam scad, anchovies and Bombay duck (Vihn *et al.*, 1996). TMA content in fresh sun-dried *Jawala* was 7.56 mg/100g tissue (Fig 1). After 2 months of storage unirradiated and radiation processed *Jawala* showed a TMA content of 16 mg/g tissue. Earlier studies in our laboratory had shown that Jawala possessed high alkaline proteinase activity (Sherekar *et al.*, 1997). Therefore alkaline proteinase activity was monitored in sun-dried *Jawala* to see the effect of radiation processing as well as storage period. It was observed that radiation processing as well as storage period did not affect the alkaline proteinase activity.

Earlier studies carried out in our laboratory had clearly demonstrated the efficacy of radiation processing to prolong the shelf life of a number of semi-dried fishery products such as Bombay duck, shrimp, anchovies and Vietnam scad at ambient temperature (Vihn *et al.*, 1996; Kwon *et al.*, 1993). The data presented on the microbiological and biochemical parameters of sun-dried *Jawala* prawns revealed that a radiation dose of 2.5 kGy could effectively reduce the bacterial growth, prevent mould growth and thus facilitate extension in storage life to 4 months at ambient temperature.

Table 2 : Total bacterial count (TBC)[a] of sun-dried *Jawala* prawns

Radiation Dose (kGy)	*Storage period (month)*				
	0	*1*	*2*	*3*	*4*
0.0	3.5×10^5	6×10^4	3.0×10^5	4×10^4	1.1×10^5
1.0	2.6×10^5	1.6×10^4	3.0×10^5	4×10^4	1.1×10^5
2.5	5.0×10^5	7.0×10^3	1.5×10^3	4×10^3	5×10^3

[a] *cfu/g tissue. Average of three independent experiments*

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Aqua farmers warned against using anitbiotics

Steps are being taken to test the shrimp at all levels - hatcheries, farms and processing plants - for Chloromphenical and other antibiotics to meet the stringent standards set by the importing European Union, U.S., Japan and other countries, Mr. M.V.P.C. Sastry, Joint Secretary, Union Ministry of Commerce and Industry, has said.

Inaugurating a workshop on 'Use of chemicals and antibiotics in aquaculture', organised by the Marine Products Export Development Authority (MPEDA) at Vijayawada on 30 May, 2002, Sastry said that all stake holders in the aquaculture industry - farmers, suppliers of seed, feed and medicines - should do their best to avoid use of banned chemicals and antibiotics during culture shrimp production to sustain our exports and foreign exchange earnings.

He pointed out that the country could ill-afford to lose the export of marine products, amounting to Rs. 6,500 crores, of which Andhra Pradesh had a lion's share. He said that Chloromphenical and other antibiotics were being used not only by farmers, but also by hatcheries and feed manufacturers in their effort to fight against diseases and increase production.

He wanted them to realise that our exports would be endangered if they continued to use the banned chemicals. Saying that this would wreak havoc with the employment-intensive shrimp culture and allied activities, he pointed out that the European Union had already banned imports of shrimp from China, affecting its trade by $ 300 million and it had also alerted Thailand, Myanmar and other countries about chemical residues. It had rejected five consignments from India.

The Chairman of MPEDA, Mr. K. Jose Cyriac, who presided, expressed happiness that usage of Chloromphenical had come down enormously due to increased awareness. He said that it was not possible to ban Chloromphenical, which was being used widely for different purposes in the country.

The Commissioner for Fisheries, Mr. D.S. Murthy, clarified that the residues were found only in scampi (fresh water prawn), predominantly grown in Nellore district, and some of these consignments were rejected by the European Union. Tiger prawn did not contain any residues, he pointed out.

The environmental specialist, Michael Phillips of Network of Aquaculture Centres in Asia-Pacific, in his presentation, tried to highlight the futility of using antibiotics for combating viral diseases in shrimp.

Thailand in Tuna search

Thailand's fisheries department is poised to carry out research into the drop in tuna catch in the Indian ocean to identify the reasons for the same. It is stated that the department's research vessel Mahidol has set sail to gathering data in this respect. Thailand's Director of Oceanic Fisheries Division is atributed with the belief that the decline in tuna catches is possibly the result of global warming. It is known that the fish is comfortable in waters with lower temperatures. It is stated that the temperature of the Indian Ocean has increased by one degree. The recent drop in foreign fleet strength fishing for tuna in Indian Ocean is believed to be on account of drop in tuna catches, particularly in waters off Thailand, it is reported. An encouraging aspect, however, is that FAO says that skipjack tuna is actually underfished throughout most the oceans.

Role of Women in Fisheries Sector of Saurashtra, Gujarat

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The Marine fishing activities of Gujarat are largely confined to the Gulf of Kutch and the coasts of Saurashtra and South Gujarat. Even so, the State tops in the production of marine fish, among all maritime States of India. One feature of the production pattern, however, is that most of the marine fish produced in the State is of low value.

In Gujarat, coastal communities are primarily engaged in fishing and related activities, the important communities among them being *Kharva, Moila (Koli moila* and *Kharva moila), Machiara [Muslims], Vadi and Madrasis.* [fishermen who migrated from Tamil nadu Kerala and Andhra pradesh, now settled in Gujarat]. Among the migrants from south involved in fisheries activities in Gujarat, Keralites form a sizeable group. In addition, a small percentage of people from the socially and economically backward communities are also involved in fishing and other activities. Most of these communities are located at major fish landing centres like Veraval, Mangrol and Porbander. The migrated and settled fishermen in Gujarat (other than those from South) are known as *Motabhai.* These fishermen are mostly of south Gujarat origin. In addition, there are those who belong to backward classes and other communities who are also involved in fishing and related activities.

A pictorial representation of major fishing communities of Gujarat and within Gujarat is shown in Fig. 1

Women in Fisheries

Women form an integral part of the work force in fisheries sector of Gujarat. They play a major role in Post harvest activities, marketing and also as processing plant workers. They work in peeling sheds, freezing plants and drying yards. They are engaged either in a single activity like processing or in more than one activity during fishing seasons.

A cluster diagram depicting various activities in which women are engaged is shown in Fig 3.

A brief description of the post-harvest activities carried out by fisherwomen in Gujarat is given here under:

Auctioning : Women take part in the unloading of fish catches from fishing boats, in sorting them out, and subsequently in their auctioning. Most of the boat owners in the State, on an average, possess six boats. They usually engage women in unloading and auctioning of the catches. Remuneration usually consists of a fixed monthly salary in addition to small quantity of fish which is given to them as an incentive. There also ex-

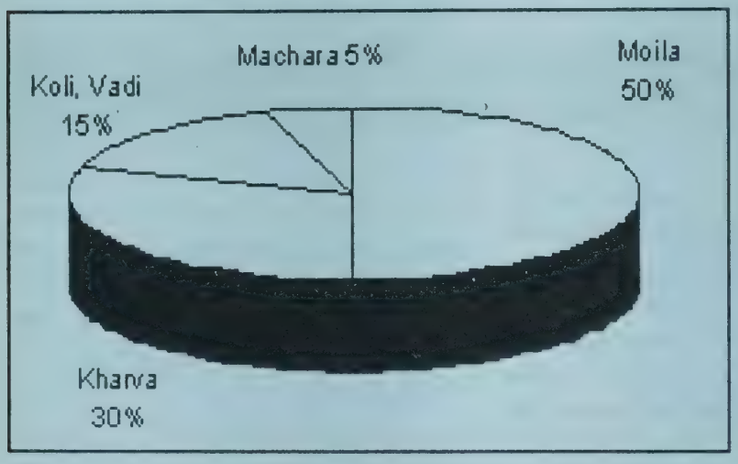


Fig 1 : Location of fisher communities at major fish landing centres

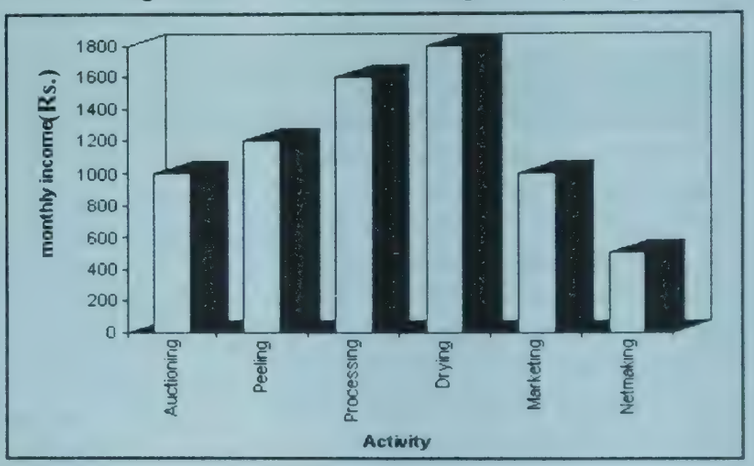
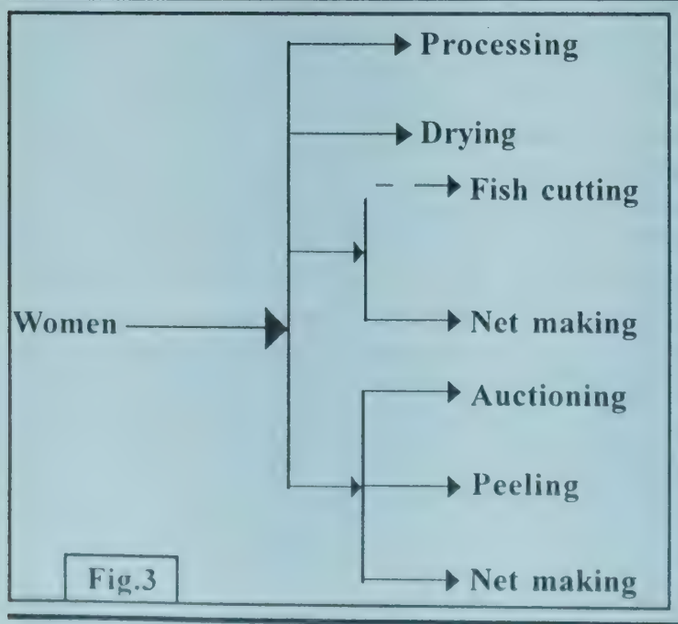


Fig 2 : Average monthly incomes of fisher women



Women engaged in retail sale of whole fish and cut pieces

Women engaged in auctioning of fish in the wholesale market of Veraval

ists a practice of borrowing some amount of money as advance from the boat owners during off season which is later deducted from the salary. This practice also involves a certain amount of bonding. Women labourers/workers get lesser amount as wages compared to the existing rates for men. Entrapment in this cycle of debt is usually of a permanent nature and is carried over from one fishing season to the other. The average monthly remuneration earned by a woman labourer is nearly Rs.1000/- per month.

Peeling : Peeling of prawn, squid, cuttle fish etc., are part of post-harvest activities along Gujarat coast. Most of the peeling work is carried out in temporary sheds having minimal infrastructure facilities. A large number of women and minor girls are engaged for peeling work. The remunaration is related to the quantity of material processed in a given time. The working time depends on availability of raw material and export demand. Due to very poor hygiene and sanitation at the peeling sheds, the women employed are often exposed to a variety of health hazards. For the women workers, the income from this activity is usually supplementary in nature i.e., women involved in peeling activities are also involved in some other related activities. Employment in this sector is not consistent as it is related to the quantum of catches diverted and available for peeling. The remuneration is approximately Rs. 30-40/25 kg and on an average a women can earn about Rs.60/- a day.

Fish processing plants : In Gujarat migrant women workers form a significant portion of the skilled/semi-skilled work force in processing plants. The women workers are usually recruited and employed by labour contractors, on predecided terms and conditions. The working hours generally comprise two shifts of six hours duration i.e., coming to twelve hours per day. The average remuneration ranges from Rs.1200 to Rs. 1800 per month. Of the total remuneration, a portion is given to the contractor as commission. Living conditions, recreational facilities and health care facilities need to be improved upon. The employment depends on the extent of fish landings during a particular fishing season. Over the past few years it has been observed that retrenchment of workers has been taking place on a mid-seasonal basis due to inadequate returns to the fish processing industry. Very little is known about the socio-economic aspects and working conditions of the women workers. Usually the workers are provided with dormitory grade accommodation within the plant premises with boarding facilities.

Most of the women belong to the economically backward families of central and southern districts of Kerala. They are employed in the peeling, grading, filleting and packaging sections of the processing plants. Some of the women also work as supervisors in some of the plants. The women are usually paid one month's salary as bonus in addition to travel expenses (fares) to and fro to their native places once a year

Drying : Fish drying is a very important subsidiary activity along the coast of Gujarat, particularly Saurashtra coast. There are a number of small and medium sized fish drying yards located near the landing centres. Majority of the work force in the fish curing yards is dominated by women. Most of the drying activity depends on the availability of raw material and concomitant export demand. There are also several temperory drying yards which are moved from place to place according to shifting fish landing centres. The labour force engaged in drying comprises mostly workers who could not be/ are not engaged in peeling. There are many migrant male labourers engaged in drying activities. Drying activity includes splitting of the fish, salting and immersing them in brine tank washing after curing and spreading them for sun drying. Remuneration paid to women workers varies from Rs. 1500 to 2200/- per month. There is no fixed working time in the yards, since most of the activities depend on the time of raw material availability. There is a need to improve the infrastructure and incorporate hygiene into various aspects of this activity. Dermatosis and Dermatomycosis are usually encountered among women involved in the practice of drying. Certain areas like Navabandar and Jaffrabad have exclusive drying yards for Bombay duck, which is regarded as a major activity. Landing of Bombay duck is also very high. Women are the dominant work

force in this activity as well.

Marketing : As per the study carried out in Veraval, it was seen that women play an integral role in marketing practices at various stages and levels in the local seafood trade. Most of the fish auctioning is done by women, the buyers being retail vendors who are also women. These retail vendors are engaged in selling fish in the local markets. There are also women and girls involved in activities like cutting of fish, cleaning fish and transportation of fish and retailing the fish chunks. On an average the income from fish cutting is Rs 50/- day. The economics of local fish marketing are complicated and involve a great deal of bargaining. There are several instances wherein fisherwomen have to resort to distress selling of fish of high value due to inadequate storage facilities and due to failure in realising the price of high value of fish. The local market is largely guided by local consumer preferences and catch composition at any particular point of time. The local market is also influenced by non-availability of fish during festival days or other days of non-fishing.

Women involved in other allied activities

Net making :While this activity is predominantly undertaken by fishermen i.e., the male members of the fisher community, it has been observed that, women, belonging to the *Kharva* and *Moila* communities fabricate some parts of nets, especially cod ends of trawl nets. This activity is mainly carried out in the off season. According to women workers, nearly 10-15 days are required for completing one cod end. The twine required for the fabrication is provided by the boat owners. Usually a group of them earn Rs. 200-250/- per cod end and for the other parts they earn nearly half that of cod end. This particular activity is carried out during the lean season and is a supplementary source of income.

Rope making : This activity is usually undertaken through the participation of most of the members of a family. Old and discarded trawl nets, gill nets etc., are used for rope making. Nets are cut into long thin strips and twisted with the help of a hand operated wheel. These ropes are used for hauling trawl nets and for mooring the boats in the jetty. This activity is mainly artisanal and done by members of fisher families.

Stone sinker making : Women are generally deployed in collecting stones from river beds and adjacent areas for making gill net sinkers. Only very few fisher families are engaged in sinker making in Gujarat. Drilling of the stones to make holes and grading of drilled stones are also done by fisherwomen. They earn approximately Rs. 30-40/- per 100 stones.

The average monthly earnings by fisherwomen from the various activities of significance shown in Fig.2.

Conclusion

Fisher communities of Gujarat are either illiterate or have education upto lower primary levels. Fishermen are thus mostly uneducated and are not aware of the importance of literacy or education. Further, the large scale availability of informal jobs is the main reason for the decreasing trend of literacy among women. Approximately 30% of fisherwomen working in the private/Govt sector are from States other than Gujarat, Poverty is not the main reason for their educational backwardness. Their interest is oriented more towards earning money and less towards education either for themselves or for their children. Awareness regarding importance of education is conspicuous by its absence. Along with this problem, several other problems exist. These are aspects such as lack of awarness pertaining to hygiene and sanitation, and poor living conditions. Another aspect which needs to be mentioned is in respect of child labour. It is generally a common practice for children to accompany their elders, especially women, to their workplace. The children casually pick up work skills by emulating the elders and eventually turn into earning members of the family. This is a tradition which is age old and is generally followed by the fisherchildren.

In the fisher community, the eldest women of the family usually handles the finances. All the revenue generated by members of the family is given to the woman-in-charge, who spends the money as per the requirements of the family. The status of women in the family is quite high and is of a responsible nature. During the off season, women from poor families work as casual labourers or as domestic help in nearby houses.

Fisherwomen in Gujarat constitute a major force in the post-harvest fisheries sector. They work very hard to earn money for the family, in addition to their normal household work. Due to illiteracy and other social barriers, they are often exploited, underpaid and suppressed.

Hence, the most important aspect which needs to be seriously considered is the issue of imparting education to fishers. Awarness programmes, regular education schedule, adult literacy programmes need to be taken up. There is an urgent need for the government, NGO's and the co-operative sector to take up this challenge and improve the status of fisherwomen of Gujarat coast.

Acknowledgements

The authors wish to express their sincere gratitude to the Director, Central Insititute of Fisheries Technology, for giving permission for the publication of this paper. Thanks are due to Messers. J.B. Paradva and H.V. Pungera for their help in data collection.

Thousands of fishes endangered by Toxic effluents

Mass mortality of fishes has been reported as having occured in Sarsa river, Solan district, Himachal Pradesh recently. The toxic effluents discharged by adjoining industrial units seem to have caused the incident, according to a report.

Most of the dead fishes, seen to be juveniles, were found along half a kilometre of Kanduwala stretch near the confluence of Baddi and Sarsa river. Mr. Rajeev Bindal, Chairman, State Environment Protection and Pollution control Board is reported to have said that samples taken from some industrial units and the river revealed the presence of death inducing substances.

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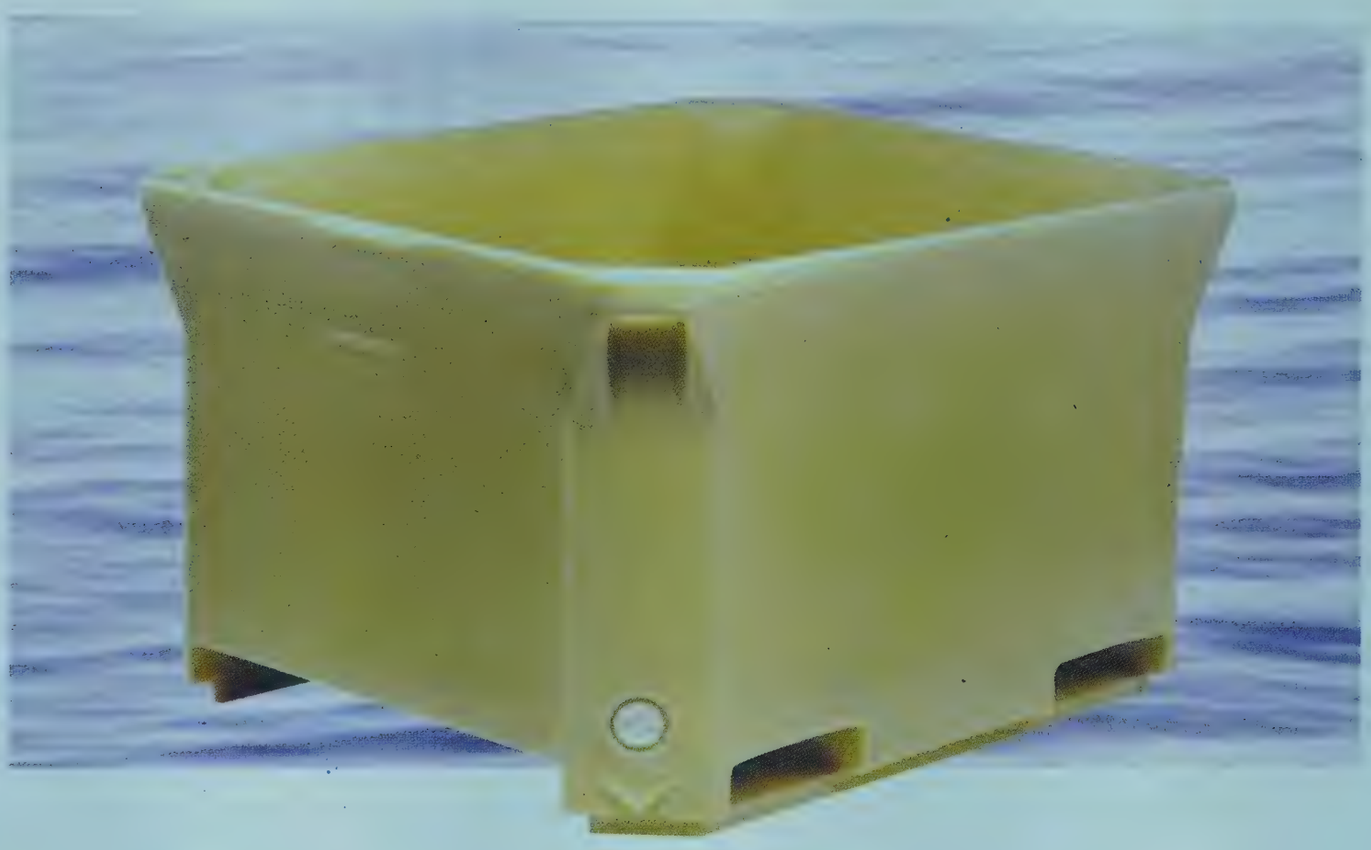

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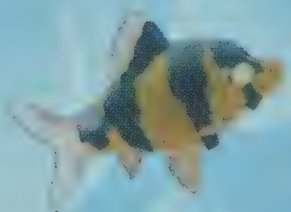

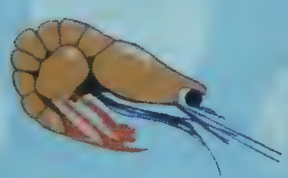

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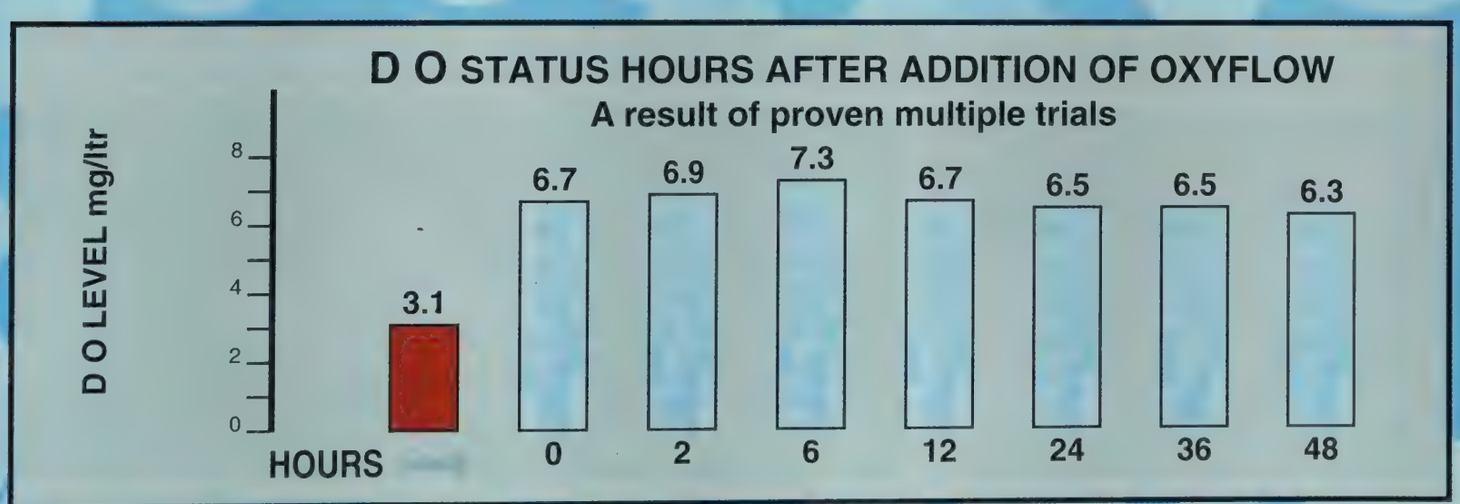

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Dr. S.L. Hora Award - 2002 for Dr. ABIDI

Dr. S.A.H. Abidi

Renowned Fishery Scientist, Dr. S.A.H. Abidi, Member, Agricultural Scientists Recruitment Board, New Delhi has been awarded Nature Conservators India - Dr. S.L. Hora Award - 2002 and Gold Medal, in recognition to his outstanding contributions in the field of Marine Resource Conservation and Management.

The award was conferred on Dr. Abidi on 25th May, 2002 at a National Seminar on "Relevance of Biosphere Reserve, National Parks and Sanctuaries (Protected Habitats) in Present Context" by Prof. Shastri Vice-Chancellor, Gurukula Kangri Vishwavidyalaya, Haridwar who hosted the National Seminar.

Book Review — Commercial Exploitation of Fisheries Production Marketing and Finance Strategies

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Publisher
Oxford University Press
YMCA Library Building
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ISBN 019 5658434

The transition from subsistence fishing to commercial fishing in Indian seas began in late 1950s and by 1970s commercial fishing emerged, by and large, as a general feature. As this transition progressed, several concomitant socio-economic changes took place. These are no doubt documented but without much of focus on input-output ratio. It has so happened that growth in marine fishing activities took place in relation to dominant target species, based on undefined and short term objectives. Of late, these and certain other features of the industry, such as progressively diminishing fleet of larger vessels, stagnancy in mechanised fishing fleet strength, and growing disinterest on the part of financing bodies to lend funds to the sector have been causing great concern. It is also known that, while several nations, particularly some of the developing Asian nations of the Pacific and Indian Ocean Zone have made progress in respect of marine fisheries development, there has been a progressive detereoration in the marine capture fishery situation of the de

Continued at p.35

Gold Medal awarded to Sugunan

The Nature Conservators, India (NATCON) have conferred **Nature Conservation Excellency Award** and a **Gold Medal** on Dr. V.V. Sugunan, Director, CIFRI. The Award is as given in recognition of Dr. Sugunan's outstanding contributions in the field of Wetland and Reservoirs Ecology, the Citation says. The Award and Gold Medal were presented to Dr. Sugunan at a ceremony conducted in the Gurukul Kangri University, Haridwar on 25 May 2002. The award was handed over to Dr. Sugunan by Dr. S.A.H. Abidi and the Gold Medal was presented to him by Prof. Dharam Pal Shastri, Vice-Chancellor, Gurukul Kangri University, Haridwar.

Dr. V.V. Sugunan receiving the Award from Dr. S.A.H. Abidi

The Award presented to Dr. V.V. Sugunan

Gold Medal presentation to Dr. V.V. Sugunan by Prof. Shastri, Vice-chancellor, Gurukul Kangri University, Haridwar

Continued from p.34

veloped countries. The comparative position had been scantily examined.

In this confusing and complex situation, this publication authored by Hrishikes Bhattacharya has come out as a beacon light. This fills up some of the vital gaps that have been inpeding the formulation of Indian marine fishing policy. These gaps have left the industry, more or less, in the lurch.

The strength of this book lies in three directions : 1) It compels the much needed focal attention on the economic and commercial aspects of Indian marine fishing, in contrast to the general run of Indian fisheries publications which tend to heavily concentrate more on the status of fisheries resources, exploited fisheries, man-power training etc., and less on economic and commercial aspects which are in fact of vital importance; 2) It provides a succinct account of declining global annual fishery situation, and the improving general fishing trends and share of fishery products in respect of developing countries, as a rich background to the graphic picture of the present status of Indian marine fisheries sector projected by the author, fortified by an appraisal of its various features, and, 3) presents the kind of well structured financing system needed to stem the stagnation in the Indian deep sea fishing industry and fox placing it on the path of growth and also suggests a plan for financial restructuring of the seafood export industry that proposes back-up by a Fund for Reconstruction. An unconventional but implementable orgnisational pattern for financing fishing vessels etc., has also been articulated, keeping in view the features that are exclusive to the industry. The system, propounded by the professor who has a vast insight and experience in industrial financing aspects and who has made a detailed study of financing problems confronting the fisheries sector, deserves the attention of the Union Departments of Banking, Animal Husbandry and dairying, the Reserve Bank of India and the Banking and marine fishing sector. The adoption of the system will go a long way in extricating the Indian marine fishing industry from its present throes of agony.

Considering that a major opening for the development of marine fisheries lies mainly in the sustainable exploitation of the underutilised tuna resources of Indian EEZ, the presentation made by the professor on the economic aspects of upgradation of existing trawlers for monofilament tuna longlining deserves attention. Another highlight of the book lies in the illuminating financial analysis of the main aspects of the marine fisheries sector of India.

The industry can do a lot to provide nutritional security to the Indian population and to contribute further to national exports (present level of annual contribution over Rs. 6000/- crores), once it has the backing of a banking system that provides a fillip to its activities as conceived and developed by Hrishikes Bhattacharya.

Assam Governor visits CIFRI's Pen Culture Site

The Governor of Assam, Lt. Gen (Rtd.) S.K. Sinha visited Samaguri *beel* in Nagaon Dt., Assam on 14 th May 2002 in which pens for fish culture were erected by the Central Inland Capture Fisheries Research Institute (CIFRI). After the visit, he expressed the view that the project was a "Crucial step towards the self-sufficiency in fish production in Assam".

CIFRI is undertaking extensive pen culture experiments covering four districts of Assam under Mission mode NATP Project, Jai vigyan Scheme on Nutritional Security for Hilly and Tribal Region. The main objective of the project is refinement and transfer of pen culture technology for ensuring food and nutritional security of the fishers of Assam.

Earlier, the Scientists of CIFRI had explained to the Governor, the basic need and objectives of launching this technology in the *beels* of Assam. The technique of fish culture in pens was explained to him. In reply to a question about the adoptability of the technology by the rural poor, scientists emphasized that this was a low cost and easy-to-adopt technology, which could be taken up by marginal fishers. This can also be effectively used to raise stocking materials and production of table size fishes and prawn, which in turn, will improve the standard of living of these people, the Governor was told.

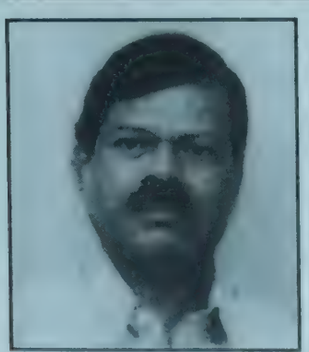
Gen. Sinha talked to the fishers and *beel* managers about their impression of the CIFRI's activities and inquired about the benefits of this pen culture technology. He was pleased when the beneficiaries showed him a haul of fish grown in pens. He expressed his deep satisfaction about the impact of pen culture technology on fishers of *beels*. He was all the more happy when gaint freshwater prawn grown in pens for the first time in an Assam *beel* were shown to him. The prawn grew to a size of 45 g in just three months. The governor was also informed about the attempts made by CIFRI to study the feasibility of undertaking the method of raising gaint prawn in pens to supplement the income of poor fishers.

The Governor also found time to spend with the scientists of CIFRI to know about other activities of the institute for furthering the fisheries development of the State. The scientists appraised him about the other research activities like efforts in developing management norms and other technological options for the fisheries development of Assam.

Rearing of fish and prawn for two consecutive years by CIFRI in Assam, has made an impact on the people of the State.

Lt. Gen. S.K. Sinha, Governor of Assam at the pen site

K.A. Dongre Retires



K.A. Dongre

Dr. K.A. Dongre, who served with distinction in various capacities in the Fisheries Department of Maharashtra for 30 years and made significant contributions to the fisheries development of the State, has retired recently from service as Deputy Director of Fisheries, on superannuation

His contributions in the freshwater sector include a) Finfish hatchery management, rearing and freshwater aquaculture; b) Integrated and composite fish culture; c) Integrated reservoir fisheries management, and freshwater prawn culture. One notable achievment of Dongre has been the establishment of Freshwater Prawn Hatchery at Dapchari, Dist. Thana.

In the brackishwater sector, Dongre was closely associated with the operation of shrimp hatcheries at Badapokharan, Dist. Thana. He had also helped individual farmers in the setting up shrimp hatcheries, shrimp farms and their operation and co-ordinated the activities.

Apart from gaining expertise in the setting up of hatcheries and construction of farms, he acquired skills in the preparation of effluent treatment plans. He is also known to have prepared a management plan for shrimp culture activities in Maharashtra.

...Towards Blue Revolution

Trained Jawans of CRPF in Punjab produce Fish Crops

Hardial Singh and Bibhudatta Mishra
Regional Research Centre of Central Insitute of Freshwater Aquaculture
PAU Campus, Ludhiana, Punjab - 141 004

The Central Reserve Police Force (CRPF) in Punjab is having a Group Centre (GC) at Saraikhas, which was established in the year 1994. Having an area of 146 acres, the Centre is located at a distance of 10 km from Jalandhar on way to Amritsar (National Highway No. 1). With a view to raising additonal funds for the welfare of families and children of force personnel who have laid their lives while fighting terrorism in the country as well as for the families of serving jawans, the GC has taken up various ancillary activities like aquaculture, horticulture, mushroom cultivation etc., in the vacant land aviatable in the campus.

A one-hectare fish pond was excavated during August, 1999. Mr. Lavesh Raikhy, a progressive fish farmer of the area and officials from the state fisheries department guided the formation of the pond. The pond was excavated using tractors. Non-availability of fish seed and technical advice at the time, was got over by the GC by approaching the Ludhiana Regional Research Centre of CIFA for assistance. Recognising the services of the CRPF personnel to the nation, the Ludhiana Centre immediately adopted their pond for providing technical know-how and other possible help. The Ludhiana Centre of CIFA arranged supply of the Indian and exotic carp seed from M/s Chatterjee Brothers (West Bengal) and Nilambar Fish Farm, Nanoke (Punjab) on complimentary basis for stocking in the GC's pond. Besides stocking 12,000 nos., in the pond about 8,000 seed was stocked in two newly constructed buffer stock ponds (0.02 ha each) during the last week of September, 1999. Composition of various species stocked were catla (15%), rohu (20%), mrigal (15%), common carp (10%), grass carp (25%) and silver carp (15%) respectively. Seed in the buffer stock ponds was raised to advance fingerling stage for multiple stocking.

The main pond was prepared following the standard procedures of pond preparation. After liming, manuring with both organic (Raw cattle dung) manure in slurry form and with inorganic (urea) fertilizers was done to promoting the growth of plankton. A water level of 1.6-2.0 m was maintained in the pond with water taken from a borewell. Fish were fed with kitchen waste and duckweed *(Lemna, Wolffia* and *Spirodela)* which are available in plenty in the roadside ditches and village ponds near the GC. For feeding grass carp, chopped bersine *(Brassica trifoliata)* and other terrestrial grasses, kitchen waste kept in perforated plastic bags, duckweed, bersine and grasses etc., placed in floating enclosures were used to serve as feed. The application of raw cattle dung slurry was suspended during winter (November-February) because of foggy weather conditions. Fishes were sampled once in a month to record thier growth, survival and health conditions.

Physico-chemical parameters of pond soil and water were monitored at fixed monthly intervals. Their ranges were: pH~ 7.41-8.12; DO~ 3.2-7.8; Electrical conductivity~ 0.380-0.690 milli mho cm^{-1}, TDS~ 0.185-0.265 ppt; Total alkalinity~ 90-140 mg/l; and Total hardness~ 120-160 mg/l. Water temperature during winter was observed to range between 5-21°C which adversely affected uptake of feed and consequently the growth of fishes.

Partial harvesting of fish was taken up from last week of March, 2000. Fish harvested from the pond was replenished in the tank by stocking with almost an equal number of advanced fingerlings/ yearlings from the buffer stock. A fish production of over 5.0t/ha/yr. was achieved during the first year, while average weight of fish at harvest was 400g. The maximum lengths/weights attained by catla, rohu, mrigal, common carp, grass carp and silver carp were 364mm/ 790g, 260mm/508g, 320mm/620g, 460mm/ 1260g, 320mm/620g 490mm/1750g and 445mm/1100g, respectively. Except for initial expenditure on formation of ponds, and occasional liming and manuring, no other expenditure was incurred particularly on fish feed. The fishes were sold to the jawans and their families in live condition on the pond side at comparatively cheaper rates when compared to market rates (Rs. 30/- per kg). This became possible because low cost carp culture technology characterised by feeding fishes with duckweed/ aquatic grasses and kitchen waste was practised, following the method of multiple stocking and repeated harvesting. Periodic removal of bigger fish resulted in faster growth of the remaining small size fish and higher production.

During his visit to the GC in May, 2000, Dr. S. Ayyappan, former Director of CIFA and the present Director of CIFE, was highly appreciative of the initiative, devotion and sincerity displayed by Sardar Gurucharan Singh, Addl. DIG, in promoting the fish culture activity. Dr. Ayyappan suggested expansion of the aquaculture activities and promised to provide all possible help/assistance to the Centre. As advised by Dr. Ayyappan, 500 nos. of the genetically improved "Jayanthi rohu" fry were stocked in the pond during September, 2000. An equal number of tagged (electronic marker) "Jayanthi rohu" was also stocked in another newly constructed pond on 22nd March, 2001. Encouraged by the results/ revenue earnings, the jawans excavated yet another pond of 2 acres, which has

been stocked with advanced major carp fingerlings.

The technologies of freshwater prawn culture and raising of broodstock of *Macrobrachium rosenbergii* was demonstrated to the Jawans on June 9, 2000. As part of this, 3,000 post-larvae (10-12mm) were stocked in a pond (0.05 ha), newly excavated by the jawans themselves. Before stocking, the pond was limed and manured to promote the growth of natural food. The baby prawns were fed with pelleted feed (crumbles) during the first 4 weeks. Feeding was subsequently done with a mixture of cooked rice and mustard oil cake using feeding trays. Feeding with semi-boiled and chopped chicken entrails and molluscan shell meat was done during the last two months of culture. Dried basal portions (2 feet) of the tree *Sachharam munja* and discarded car tyres were placed at different points in the pond to act as artificial substrates/shelters for the prawns during moulting. The prawns exhibited very good growth and survival. Average weight attained by the prawns was 50g with a survival rate of more than 60%. For making a correct assessment of stocks, the pond was de-watered on November 9th, 2000 to retrieve all the prawns. A total of 75 kg healthy prawns (42-100 g) were collected giving a production of 1.5 ton/ha/150 days. Nearly 35% of the female prawns were fully gravid and in good condition.

Starting from pond excavation/preparation to harvesting of fish and prawns, all the culture operations including drag netting have been done by the jawans themselves. As such, over 48 force personnel have received practical training in fish/prawn farming on the principle of "Learning by doing". Many jawans have decided to take up aquaculture after retirement. The Ludhiana Centre of CIFA is committed to encouraging intensification of the programmes further and imparting hands-on training to more CRPF personnel in freshwater fish/prawn culture, besides raising additional funds for their welfare.

Japan Plans to raise catch

Japan's fishery ministry says it is hoping to boost the country's seafood self-sufficiency from 55 to 65 per cent by 2012.

This push is an effort to increase self-sufficiency instead of relying on foreign suppliers.

According to the Ministry's ten-year plan, meeting this goal will require bringing up the production of seafood from 4.61 million tons to 5.26 million tons.

This is bad news for the many fishing nations around the world which rely on the Japanese market.

However, Japanese fishery ministry is worried that the movement of young people from traditional fishing villages to bigger cities will make Japan even more reliant on import of fish products, it is reported.

Another plan has been designed by the Japanese government to counter this trend is to introduce a five-year scheme to invest in 430 fishing village districts, and 350 facilities for improving production and transport, plus 750 aquaculture projects.

Fisheries Resources of Assam and Scope for their Development

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Assam, the second largest State in northeast India accounts for 30.75% of the geographical territory of the region. Although agriculture is the mainstay of Assam's economy, the level of its development and allied activities in the State during the last few decades has been on a lower key. Despite rich soils, plenty of water, good varieties of paddy and above all good traditional knowledge in farming practices, the State has one of the lowest yields and overall agricultural production in India. In tune with the trend, this State which abounds in lakes and ponds, and other enviable aquatic resources lags behind in fish production. Assamese penchant for fish needs no elaboration. They simply adore fish and 95% of them are avid fish eaters. It is a sad commentary that a State with 1.5 lakh ha of inland water bodies and 5,000 km long river stretches should import inland fish from other states.

Fisheries Resources of Assam and their Production Potential

Assam is endowed with rich aquatic resources eminently suited for fisheries development. The rivers Brahmaputra and Barak along with their numerous tributaries and rivulets have been a traditional source of fishing for the people of the State from time immemorial. Similarly, the ubiquitous floodplain lakes of Assam, popularly known as *beels* and ponds are the main sources of fish production. New forms of integrated fish production techniques to combine fish culture with poultry, duck and pig farming have also emerged.

Resource Size

Inland fishery systems fall under three broad categories viz., capture fishery, culture fishery (aquaculture) and culture-based fishery. Capture fishery is fishing in open waters like rivers, where the catch depends on the natural fish stock. Aquaculture is practised in specially prepared ponds in which fingerlings are stocked, fed, and harvested. Culture-based fishery is a combination of culture and capture fisheries where the fish stock of open water bodies like *beels* and reservoirs are augmented to a sustainable level of capture-culture balance through stocking of advanced fish fingerlings. Assam has water bodies, which are amenable for practising all the three aforesaid kinds of fisheries. These resources along with their fish production potential are outlined in Table 1.

Riverine Fisheries: The Brahmaputra and Barak river systems form the backbone of capture fisheries of the State. The river Brahmaputra runs from east to west for a distance of 730 km with an average width of 8 km. During floods, the river leaves a blanket of fine silt that imparts fertility to the land. During its course in Assam, the river Brahmaputra receives as many as 47 tributaries from north (Dibang, Dihang, Subansiri, Jia Bhorelli, Pagladiya, Manas, Salarbhang and Sankosh) and south (Lohit, Didang, Dhansiri, Kollong, Kulsi and Jinjiram) banks. The north bank tributaries mostly traverse the hills and have a very steep slope, compared to the south bank tributaries which have meandering low gradient and comparatively low silt charges. The river Barak rises from the Japfu peak and receives a number of (12) tributaries mainly from the south. The total length of rivers in Assam is estimated at 5050 km.

Brahmaputra harbours some of the prime and economically important fish species of the world such as the Indian major carps (*Labeo rohita, L. calbasu, Catla catla*, and *Cirrhinus mrigala*) catfishes (*Wallago attu, Silondia silondia, Pangasius pangasius, Aorichthys seenghala, A. aor, Bagarius bagarius, and Ompok bimaculatus*). Although there are no official fish catch statistics of the rivers in Assam, observations made by the Central Inland Fisheries Research Institute (CIFRI Bulletin No. 97) indicate a declining trend due to habitat loss.

Beel Fisheries: *Beels*, which are wetlands associated with the riverine floodplains are an integral component of Brahmaputra system. Most of them are oxbow lakes, but lakes of tectonic orgin are also present. There are 1,392 beels of various extents in Assam, covering 100,000 ha. Over 30% of them (60,000 ha) are registered fisheries. Together, they

Table 1. Fisheries resources Assam and their production potential

Resource	*Resource size*	*Production potential(t)*
Riverine fisheries (capture) Riverine	5,500 km	5,500
Culture fisheries : Ponds and tanks	25,000 ha	1,00,000
Integrated culture systems	26,000 ha	46,000
Capture-Culture based fisheries		
a) *Beel* fisheries	1,00,000 ha	1,00,000
b) Reservoir fisheries	1,500 ha	150
Swamps & Low lying areas	10,000 ha	10,000
Total	1,46,090 ha	2,61,650
	5,500 km	

contribute 83% of the total lentic area in the State. No authentic accounts are available on the fish production from *beels*.

Reservoir Fisheries: Reservoirs have been very recently added to the State's potential fishery resources. Consequent to the damming of the river Kopili for hydro-electric generation in North Cachar district two reservoirs with a total waterspread area of 2,326 ha have come up. The smaller of the two, Umrong reservoir (991 ha), is totally located within the State, while Khandong (1,335 ha) extends beyond Assam's geographic limit into the State of Meghalaya. About 60% of its waterspread is in Meghalaya. Thus, the total area under reservoirs in Assam is estmiated at 1,525 ha. At present, there is no organised fishing in these reservoirs, but they offer good potential for planned scientific development of the reservoirs for sustained exploitation of their fishery resources.

Ponds: Ponds constitute the most important source of culture fisheries in the State. Ponds are ubiquitous in rural Assam and fish culture in them is a deep-rooted tradition. Since conversion of swamps as well as prime agricultural land into fish ponds is taking place in some of the districts, it is difficult to arrive at a realistic figure of the actual area presently under pond fish culture. According to the State Department of fisheries, the total waterspread area under ponds is 25,000 ha, which can be an under estimate.

Fish Requirements of Assam and present level of Production

There is no reliable data on annual fish production of Assam. The State Fisheries Department's present organisational structure and mechanism to collect fish catch statistics from rivers, *beels* and pond culture systems is inadequate. So much so, no wonder, the figures quoted by the department are mostly off the mark. According to official figures, the fish production in Assam increased from 0.5 lakh t in 1985-'86 to 0.76 lakh t in 1990-'91, registering an increase of 50% at a growth rate of 5,000 t per annum. During 1991-'92, the production had further increased to 1.30 lakh t. The current production is around 1.5 lakh t per annum according to official sources and resource-wise break-up is not available (Source: Handbook on Fishery Statistics, Ministry Agriculture, Govt. of India).

Demand and Requirement of Fish

Demand of fish is linked to levels of production, consumption needs, income levels and purchasing power. No reliable studies have been made so far on the demand and supply of fish either for the country as a whole or for Assam State. However, a per capita fish production of 11 kg per year on a national basis is generally considered as the requirement. Accordingly, at the present level of population (95% of them fish eating), Assam requires 2.6 lakh t of fish. That there is a gap between supply and demand is obvious from the high prices and the steady inflow of fish from Andhra Pradesh.

Scope for Production

Various types of water bodies in the State have the potential to produce the required quantity of fish by increasing productivity through technological upgradation and bringing in new concepts of fish production as described below:

Capture Fisheries

The fish yield rates from rivers vary widely depending on the geo-climatic factors, terrain and the richness of fish faunistic resources. Fish yield obtained from some of the rivers in India is reported to vary from 0.64 to 1.6 kg/km (Jhingran, 1991). It is often believed that optimum fish yield attainable from Indian rivers is stated to be 1 t/km (National Commision on Agriculture, 1976). However, Brahmaputra, with its relatively pristine environment, rich fish fauna and by virtue of its phenomenal width, is considered to yield fish at rates much above that national average. Although mainstream Brahmaputra can produce more than this, taking into account the tributaries and other rivers in the State, the overall fish yield potential of the rivers of the State can be taken as 5,500 t at the rate of 1 t/km.

The riverine fishery is plagued by many undesirable factors. They include degradation of environment, catching of fish in undesirable size, use of irrational fishing methods and destruction of broodstock. In order to attain the desired level of production several measures are required to be taken, some of which are listed hereunder:

1. Conservation of riverine ecosystem,
2. Determination of optimum level of fishing effort,
3. Protection of *beels* and other wetlands associated with rivers,
4. Facilitating water renewal in beels and other wetlands,
5. Protection of breeding grounds,
6. Prevention of catching broodstock and juveniles,
7. Imposing ban on riverine fish seed collection,
8. Launching of river ranching programme, and
9. Sensitizing the fishers about the conservation measures.

Riverine fishermen represent one of the weakest sections of our society. They are socially and educationally ill equipped to understand the nuances of measures described above. Therefore, a massive drive to create awareness among them about these is an essential prerequisite to achieve higher fish yield from rivers.

Culture-based Fisheries

Beels and resevoirs constitute the resources for developing culture-based fisheries in the State.

Beels constitute the prime inland fishery resource of the State by providing scope for producing large quantities of fish through adopting culture-based fisheries. These are organically productive ecosystems with a conducive environment for fish growth.

However, most of the *beels* in the State remain in derelict state with little management resulting in poor fish production. The main cause of this condition is the widespread weed infestation. Most of the *beels* are subjected to intense anthropogenic stress in the form of embankment formation and dewatering associated with paddy cultivation. These hasten the natural process of swampification. Mostly, floating, submerged and rooted emergent aquatic plants colonise the *beels* preventing the production of plankton, which is an essential food component of the quick growing carp species. The weeds provide shelter for predatory catfishes and obstruct the use of many fishing gears. Thus, periodic clearance of weeds becomes an important step in managing the fisheries of *beels*.

There are two complementary approaches for increasing the fish production from *beels*. One is the creation of a battery of (1 ha unit each) enclosures along the margin of beels. These aquaculture units can be leased out to entrepreneurs for growing fish in captivity. While productivity at par with the pond culture system can be obtained in this manner, the other associated approach is to stock the main *beel* with the fingerlings of economic species. If the experience of West Bengal in managing the *beels* serves as a guide, a yield rate of 1,000 kg/ha is obtainable by practising culture-based fisheries in the *beels* of Assam. The margin oriented pond culture system can yield much more. On an average the 100,000 ha of *beels* in the State can yield a total production of 100,000 t at one t/ha.

The State has sizeable areas of swamps which are derelict and semi-derelict water bodies, either perennial retaining water during the dry season or purely seasonal. It is assessed that 10,000 ha of such low lying weed infested wetlands are lying fallow. Marginal renovation of such waters can generate additional areas for pisciculture. These water bodies are ideal for raising live fishes such as *Clarias batrachus* (magur), *Heteropneustes fossilis* (singhi), and *Anabas testudineus* (koi), which are highly relished by the people of Assam. Although these water bodies are highly productive, there is difficulty in harvesting the stock due to weed infestation and swampy nature of the ecosytem. However, by adopting appropriate technologies a yield rate of 1,000 kg/ha can be achieved from these resources.

An important aspect of reservoir fishery management is stocking of fingerlings in desired size and number. It is therefore necessary to create necessary infrastructure facilities such as hatcheries and seed rearing ponds to produce adequate fish seed. Proper stocking and fishing effort management in reservoirs can ensure a yield rate of at least 100 kg/ha. Thus, a total of 150 t of fish can be produced from the existing reservoirs in the State.

Culture Fisheries

During the last two decades, the country has witnessed a rapid growth in freshwater aquaculture. Assam has missed this blue revolution due to many reasons. When States like Andhra Pradesh could make big strides in freshwater aquaculture, it is a pity that Assam with its enviable aquatic resources had to lag behind. Paradoxically, Assam imports inland fish from Andhra Pradesh. Although a yield rate up to 10 t/ha has been demonstrated by research institutes in India, considering the acidic nature of the soil and other environmental constraints in Assam, the attainable target is 5 to 6 t/ha. Even at a more modest yield rate of 4 t/ha, the 25,000 ha of ponds in the State can produce fish to the tune of 100,000 t. There is also scope for creating more ponds in the low-lying marshy areas.

Integrated culture systems : In recent years, integration of fish culture with other agricultural and animal husbandry practices is catching the imagination of people. These systems are not only cost-effective; they are also in tune with the concept of waste recycling. The common integrated systems are paddy-cum-fish culture, duck-cum-fish culture, poultry-cum-fish culture and pig-cum-fish culture.

Integrating paddy cultivation with aquaculture is a traditional practice followed in many parts of India, although this is not done on scientific lines. By modifiying the paddy plots, fish culture can be integrated with paddy cultivation in many lowlying areas, especially in lower Assam.

In sequential culture, crops of paddy and fish are alternately produced. In synchronized system, water resistant variety of paddy and fish are grown together. When water recedes the fishes take shelter in specially prepared pits. It is estimated that 20,000 ha of paddy fields in the State can be modified to accommodate this integrated system to produce additional 24,000 t of fish.

Since waste from pigpens are rich in nitrogen they act as excellent pond fertilizers and fish feed. By combining the two systems, the input cost of aquaculture can be brought down substantially. Thus, pig-cum-fish culture is a highly profitable venture. This has special relevance in the tribal areas of the northeast where pig farming is very popular. It has been estimated that 7 t of fish and 4,500 kg of pig meat can be produced from one ha farm annually. Since this practice is not prevalent in Assam, people have to be encouraged and motivated to adopt this system. If 2,000 ha are developed as a first phase, it would ensure production of 14,000 t of fish.

Poultry and duck farming systems can be similarly linked with aquaculture to result in considerable economic advantage. Under poultry-cum- fish culture, 5 t of fish, 1,250 kg of chicken meat and 70,000 eggs can be produced from 1 ha farm. In duck-cum-fish farming, the figures are 4 t of fish, 750 kg duck meat and 6,000 eggs. If 2,000 ha each can be developed for poultry-cum-fish culture and duck-cum fish culture, they can bring in additional fish production of 10,000 t an 8,000 t respectively. Thus the four types of integrated systems can add additional fish production of 46,000 t.

Challenges Ahead

The task of increasing fish production in Assam on lines suggested above

Table 2. Participation of private and cooperative sector in fisheries development

Resource	Ownership/Lease
Capture fisheries	
Riverine fisheries	Fishermen's cooperatives
Culture fisheries	
Ponds and tanks	Private sector
Integrated culture systems	Private sector
Fishery estates	Private sector
Culture-based fisheries	
Main beel	Fishermen's cooperatives
Reservoir fisheries	Fishermen's cooperatives
Swamps & Low lying areas	Private sector

is riddled with many constraints. Even though the State is producing enough quantities of fish spawn, and fry, substantial facilities are not available for growing fish spawn into fingerlings stage to stock *beels* and reservoirs (100 mm size is required for stocking in *beels*). Thus, non-availability of quality fish seed in adequate numbers is a constraint. Poor post-harvest infrastructure including marketing channels also come in the way of fisheries development. Presently, the market is controlled by middlemen and mafia. The management of fisheries resources of the State requires highly skilled manpower, which is presently lacking. This becomes all the more important, considering the fact that a substantial part of the resources in Assam comprise capture or culture-based fisheries. Careful planning at the highest level is required while formulating yield enhancement options in order to avoid conflicts with environmental conservation norms.

Essential prerequisites to achieve the projected fish production of 2.6 lakh t are:

1) Extension drive by the State government to disseminate the know-how on fish culture,
2) Training of entrepreneurs in the research Institutes on the latest aquaculture techniques,
3) Creation of awareness among the fishermen on the conservation of riverine and *beel* environment,
4) Adequate credit flow to the entrepreneurs for aquaculture ventures, and
5) Special measures to ensure flow of credit to fishermen to buy fishing craft and gear.

Socio-economic Implications of Developing Culture, Capture and Culture-based Fisheries

Development of culture fisheries in ponds and integrated systems is captial intensive and can be normally taken up only by well-equipped entrepreneurs and private sector companies. Since well-defined technology packages are available for these systems, it is not difficult for them to raise the required capital. The profits derived from such ventures are also handsome. Yet, such ventures are not coming up in Assam, probably due to prevailing social insecurity. As in the case of other industrial ventures, creation of the right ambience for development is a necessary prerequisite. Private sector can play a key role in developing aquaculture in ponds, *beels*, swamps and under integrated culture systems. Fishing rights for rivers and *beels* should be given to the cooperative societies of fishermen comprising the local communities (Table 2).

Providing the capital needs for the fishermen who work in the capture and culture-based fishery systems are much more complicated and challenging. Their needs are to be met by government owned funding agencies, as the private institutions are relcutant to advance loans for capture fishery operations of the fishermen. Apart from the uncertainties of catch, they cannot often fulfil the criteria set by financial institutions regarding collateral, sureties, etc. Nevertheless, the capture and culture-based fisheries need to be developed, as they are environment-friendly and employment-oriented. By providing access and means of livelihood to the weaker sections of the society, these systems also serve to meet some social obligations. Unlike the culture systems, where the profit is assured to a single investor or a small group of investors, in open water fisheries, the cake of profit from increased yield is more equitably distributed among a large number of people, albeit in smaller slices. This, being a community-based development process, has a direct bearing on the rural populace of this socio-economically sensitive region of the country. The social problems specific to the North-east such as those related to land holding system, access to water bodies, etc. may also come in the way of developmental plans. Concerted efforts are needed to overcome these constraints in order to optimise fish production from the rich and diverse aquatic resources of Assam.

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A STORY GOES : A farm hand was sent out from a fish farm as he was found to be illiterate. He then managed to set up his own farm and all his earnings he was depositing in his Bank from time to time.

One day, after a few years, when he was at the Bank depositing money, the Manager called him and said, "There is now a substantial amount in your account. You can invest it and earn interest. I will prepare papers and you have only to sign". The farmer replied. : 'I am illiterate. I cannot sign'. Surprised, the Manager exclaimed. 'Can you imagine what you would have been, had you been a literate?.' Pat came the farm hand's reply : 'I know sir, I would have continued as a farm hand.'

Institute (CIFT) - Industry Meet

14 April, 2002 : Visakhapatnam, A.P.

An 'Institute-Industry Meet' was organized by Central Institute of Fisheries Technology (CIFT) at Visakhapatnam on 14th April 2002, in which representatives of fish processing industry, boat owners, State and Central Fisheries Research and Training Institutes, Non Governmental Organizations, MPEDA and aqua farmers participated and interacted on policy matters, and aspects of responsible fisheries, value addition, quality control, priorities in research, product development, training, transfer of technologies, consultancy aspects etc.

Dr.P.Varalakshmi, MLA, Visakhapatnam-II, inaugurated the Meet. In her address she lauded the achievements of Central Institute of Fisheries Technology, particularly in respect of the introduction of fish curry in flexible pouches which had good potential in urban markets and in conducting of training programmes on preparation of value added fish products from low cost fishes, which would provide employment opportunities for rural women and youth. She stressed that the growth of fishing industry depended mainly on the economic growth of fisher community. She said : fisher folk should be provided with all modern technologies and modern motorized boats for better and speedy harvesting.

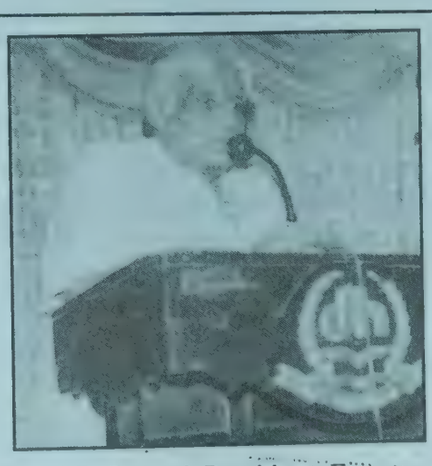
Chief guest of the day Dr. K. Gopakumar, Dy.Director General (Fisheries), Indian Council of Agricultural Research, New Delhi, informed that a comprehensive National Fisheries Policy for the growth of fisheries sector had been submitted to the Government. He emphasised the bio-technological applications for eco-friendly sustainable aquaculture. He said there was a need to intensify the export of fish since the country was lagging far behind other Asian countries in this regard. The latest technologies were being adopted in Thailand, a major competitor to India. The same technologies should be imple-

Dr. P. Varalaxmi, MLA, Visakhapatnam inaugurating the Meet by lighting the traditional lamp. Dr. K. Devadasan, Director , CIFT looks on

Dignataries on dais

Dr. K. Gopakumar, DDG (FY), ICAR, New Delhi, Chief Guest of the day, speaking on the occasion

Felicitation by Dr. C. Babu Rao, Chairman , Suvarna Rekha Marines (Pvt) Ltd., Visakhapatnam



Dr. K.R. Prasad, President, Forum of Fisheries Professional of India, speaking on the occasion

mented in India for better export prospects. He stressed on the need to develop fish hatcheries on more scientific lines. He assured that the recommendations of this Meet would be submitted to the Ministry.

A section of the participants attending the meet

Pointing out the inescapability of introducing sea cage farming, particularly in the context of declining marine capture fishery output, Gopakumar exhorted the Indian enterpreneurship to emulate tuna and sea bass cage farming systems followed by the Australian industry. He underscored the point that the Government should initiate needed measures for the introduction of sea cage farming, adding that, if this was not done India would not be able to compete effectively in the International aquaproduct market. Highlighting that only 49% of the budget outlay in the Central sector was utilised last year, he said that, by taking up useful and production-cum-export oriented programmes such as those revolving round cage culture, not only there would be fuller utilisation of funds, but there would also be increase in fish production as well as in the exports. Gopakumar said that fish farming would not cause any tangible pollution, while deprecating the unjustified point of view projected by environmentalists. He said that eco-friendly fish farming in one ha of area gave a return of Rs 60,000 which was far higher compared to returns from paddy farming but the spread of fish farming would be possible only when there was policy support from the Government.

Dr K.Devadasan, Director, CIFT, Cochin, in his presidential address stated that the Institute - Industry Meet was held at Visakhapatnam because in the near future Visakhapatnam would be the capital of fisheries activities in the country. He also briefed on the technologies developed by CIFT in both harvest and post harvest areas. He emphasized that adequate importance should be given for the domestic marketing of fish and fishery products. He emphasised the importance of regular feed back from the industry for refining the technologies to suit their needs. Observing that the industry was now at cross roads, It was appealed that focal efforts at diversification of fishing efforts and also in respect of production of value-added items so as to compete in the export market would have to be made. Referring to the freshwater aquaculture sector, Devadasan pointed out the need for diversification of species for culture keeping the export aspect, besides the changed demands in the internal market, in view.

Industry in Terminal Stage of Illness

Felicitations were extended by Dr.C. Babu Rao, Chairman, Suvarna Rekha Marines, Mr. Y.Surya Rao, President, Seafood Exporters Association of India (Andhra Pradesh Region) and Dr. K.R. Prasad, President, Forum of Fisheries Professionals of India, Visakhapatnam. Dr. C. Babu Rao prefaced his felicitation address with the startling but yet a factual observation that the Indian fishing industry was in the terminal stage of illness. However, he felt that the situation could still be retrieved through needed policy intiatives. Government allowed the industry to revolve mostly round shrimps mostly and this had led to the present crisis. Through organising diversfication of fishing effort only, the situation could possibly be saved, he said. It was mentioned by him that Australia succeeded in saving their fishing industry from various problems through implementation of well designed policy measures and India could follow this example. He commented that the Fishing Survey of India conducted academic surveys but the need was to conduct commercially oriented surveys oriented towards economics of operation related to viable species. It was pointed out that government would have to distinguish between those who would stay in the industry and those who belonged to the opportunistic and fly-by-night category of entrepreneurs. He pleaded for the setting up of a core committee to cater to needs of all fishing centres of the country. He supported the need for promoting sea cage culture as expressed by Dr. Gopakumar. Speaking on the situation in Andaman and Nicobar waters, he expressed his dismay that the concerned officials in the territory behaved as if they belonged to a different country which had made obtaining permissions for fishing in the EEZ of Andaman and Nicobar islands so difficult. It was necessary for the Ministry of Agriculture to look into this problem and advise the officials of the administration to change their attitude. Unless this was done the utilisation of the rich resources around Andaman and Nicobar islands by Indian enterprises would be difficult and the poaching vessels from other countries would continue to have a sway in the area.

Mr. Y. Suryarao, in his felicitation address, commended the initiative taken by CIFT in organising the meet. He said that periodical meetings of this kind would go a long way in providing a fillip to the industry. Referring to exports to EU, he pleaded for provision of needed facilities for conducting confirmatory tests in regard to quality at CIFT's Centre at Visakhapatnam. (Intervening, Dr Devadasan said that these facilities were being provided. At the same, he suggested that a competetent consultant could be hired for the purpose. Further, 50% subsidy would be given for engaging skilled manpower as required and as acceptable for the purpose, he added.

Dr. K.R. Prasad, speaking on the oc-

casion, made several suggestions. One was that CIFT could introduce participatory programmes with the industry. Another observation was that the government should encourage introduction of multipurpose vessels, supported by relevant training and extension programmes. He pleaded for the setting up of fisher clubs to act as centres for exchange of views and dissemination of ideas. Observing that a large country like India, endowed with vast fisheries resources needed and deserved a separate fisheries ministry, he pleaded that government should take immediate steps in this regard.

Earlier, Mr. S.S. Gupta, Scientist-in-Charge, Visakhapatnam Research Centre of CIFT welcomed the gathering and Dr.D.Imam Khasim, Principal Scientist proposed the vote of thanks. Dr. Meenakumari, Head of Fishing Technology Division, Dr. K.G. Ramachandran Nair, Head of Fish Processing Division and Mr. M.Nasar, Principal Scientist (Engineering) at CIFT, Cochin participated in the programme and the queries on harvest and post harvest technologies raised by some of the participants were answered by them.

In the interactive session, fishing industry representatives wanted the announcement of a comprehensive fishing policy, diversification of fishing systems on fishing vessels for catching tuna, supply of the design of CIFT's fuel efficient fishing vessel to the industry and training in diversified deep sea fishing methods. Non Governmental Organizations wanted more of training programmes to be conducted on value added products and hygienic drying of fish to traditional fisherfolk. The aquaculturists felt that alternatives to tiger prawn farming should be explored. Responding to these issues, Dr.K.Devadasan informed that some of these issues were already addressed to by CIFT and its Research Centres and assured that other issues would be given due consideration.

The 'Meet' was well attended and it reflected the keeness of the entrepreneurs to know about modern technologies available with the Institute and their readiness to utilize them. Many participants expressed the need for similar Meets at regular intervals, participated by all concerned with marine exports/marine industry so that marine fisheries fraternity as a whole can be benefited form the research activities carried on by CIFT.

Giant Freshwater Prawn holds Aquaculture Potential in North A.P

As a step towards diversification in aquaculture sector, it is reported that the AP Fisheries department has decided to encourage farmers of North A.P to take to Giant Freshwater Prawn (GFP) culture.

This inititative has been taken, as a follow-up to the GFP culture that has already become popular in South A.P and as a support to the efforts of the Marine Products Export Development Authority (MPEDA) which has been championing the cause of diversification in export-oriented aquaculture. It is known that shrimp exports have been stagnating in recent times owing to the whitespot virus disease that has afflicted shrimp under culture in ponds.

The significance of diversification from shrimp culture is also underscored in the context of at least one major importer in USA commending the quality of imported GFP into USA.

MPEDA has also come up with a scheme for the promotion of GFP culture through technical and financial assistance for GFP hatcheries and farms. It is learnt that AP State Fisheries Department is also now taking up a scheme entailing procurement of one lakh scampi seeds from Gotta barrage in Srikakulam district for their release in tanks, ponds, and small reservoirs of the State.

According to MPEDA sources, exports of GFP increased in recent years from below 200 tonnes in 1996 to 7,140 tonnes during 1999-2000. AP leads in GFP production (6,510 ha) followed by West Bengal (3,500 ha) and Kerala (710 ha).

It is estimated that, out of the total available Indian freshwater potential (5.4 million ha), the induction of atleast 50,000 ha for GFP culture would result in an additional GFP production of, at least, 25,000 tonnes, which would fetch additional foreign exchange earnings of Rs. 750 to Rs. 1,000 crores.

First Value-added Seafood Conference

Consumer demand for seafood continues to rise, and the value added seafood sector in particular has shown rapid growth.

In response to this trend, the first value Added Seafood Conference will be held in the UK this autumn. It will take place from September 26-27 at the Holiday Inn Regents Park in London.

The Conference will provide a forum for all those involved with the value-added sea food market, retailers, processors, producers and suppliers to exchange ideas, get the very latest market information and, of course, do business.

The programme will address the key opportunities and challenges facing the industry right now, including the impact of developments in aquaculture, the growing market for value-added seafood in food service and successful marketing strategies for seafood.

With a high quality speaker panel being lined up, this conference is aimed at senior decision makers in the industry.

For more details contact : David Monaghan, Agra Europe, 80 Calverley Road, Tunbridge Wells, Kent TN1 2UN, UK. Tel: +44 1892 511807 Fax: +44 1882 527758

E-mail: david.monaghan@informa.com
Web: www.agra-net.com

Bombay Aquarium Society : Golden Jubilee Celebration

Mumbai : 24-27 Jan, 2002

Bombay Aquarium Society, the oldest aquarium society in India celebrated its Golden Jubilee from 21 to 27 January 2002. The Society was established in 1950. As a part of Gold Jubliee Celebration, a Live Aquarium Fish Exhibition was organised in Gomantak Hall, Vile Parle, Mumbai, which was inaugurated by Dr. V.S. Somvanshi, Director General, Fishery Survey of India. A Workshop on "Breeding and Farming of Aquarium Fish and Plants " was organized on 24 Jan, 2002. This was inaugurated by Dr.Shankar rao Magar, Vice Chancellor, Konkan Agricultural University, Dapoli. 30 participants engaged in aquarium fish keeping and farming participated in the Workshop. The response for the exhibition was overwhelming. Over one lakh persons, visited the exhibition. On the last day, i.e., 27th January, at a special function, a Life Time Award in the form of Dharamkurisinghji Trophy was given to Mr. S.J. Shroff for his major contribution in developing aquarium fish hobby as well as industry. The Trophy was presented to him by His Highness Maharao Mr. Pagmaljisaheb Sawai Bahadur of Kutch, in the presence of Mr. D. A. Biwalkar, Assistant General Manager, ICICI. The Society proposes to organise very soon an All India Workshop on Aquarium Fishes for promoting the industry.

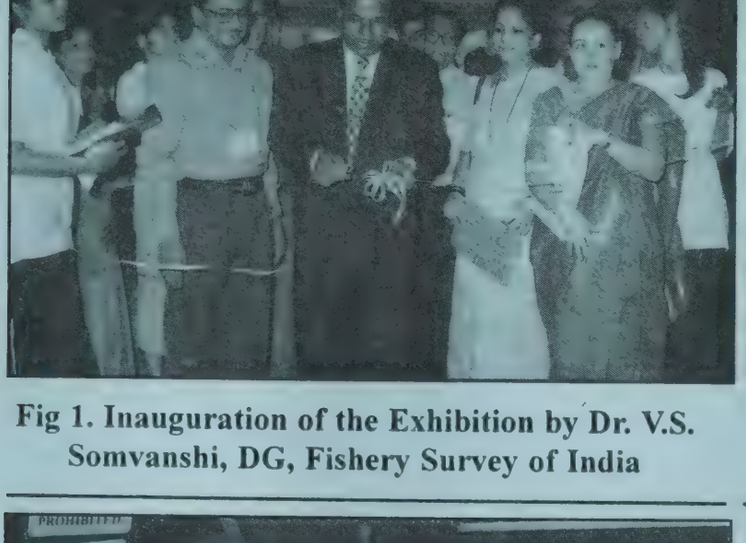


Fig 1. Inauguration of the Exhibition by Dr. V.S. Somvanshi, DG, Fishery Survey of India

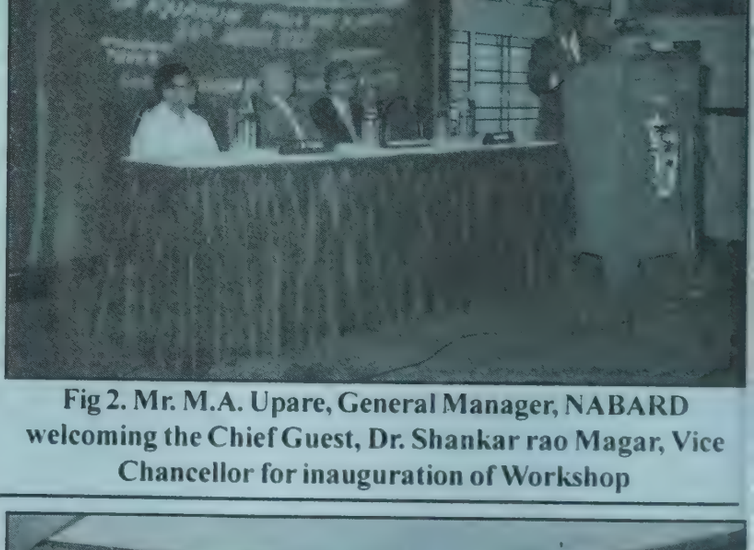


Fig 2. Mr. M.A. Upare, General Manager, NABARD welcoming the Chief Guest, Dr. Shankar rao Magar, Vice Chancellor for inauguration of Workshop

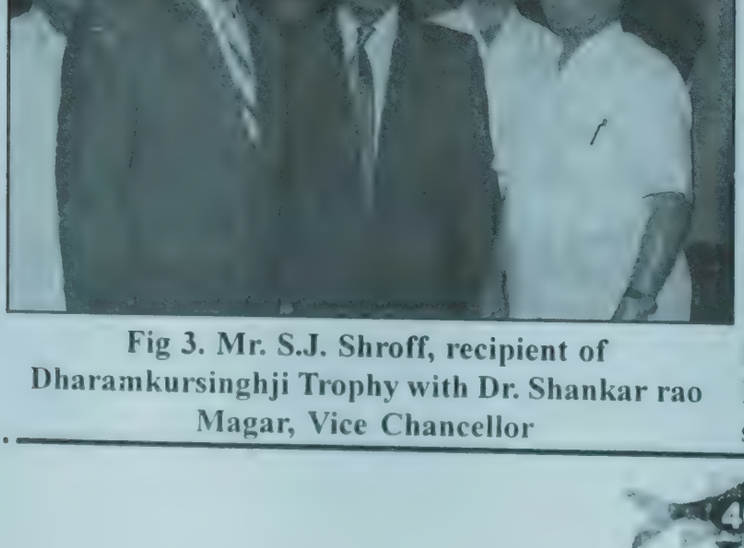


Fig 3. Mr. S.J. Shroff, recipient of Dharamkursinghji Trophy with Dr. Shankar rao Magar, Vice Chancellor

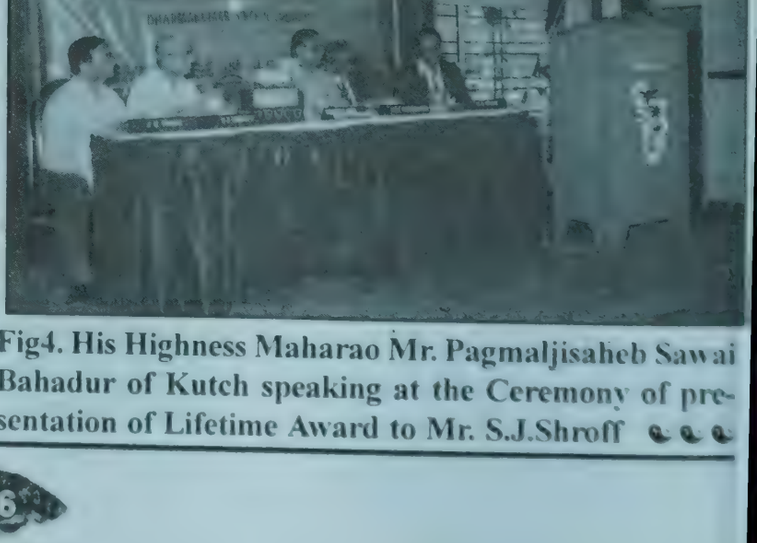


Fig4. His Highness Maharao Mr. Pagmaljisaheb Sawai Bahadur of Kutch speaking at the Ceremony of presentation of Lifetime Award to Mr. S.J.Shroff

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Meeting on

Use of Chemicals and Antibiotics in Aquaculture

Nellore, A.P. : 23 May, 2002

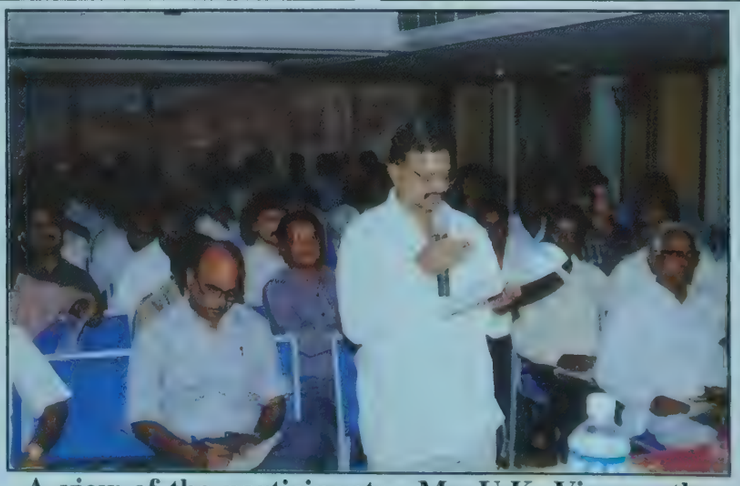
Countries such as Japan, USA and EU who import shrimp/prawn from India have warned the Indian exporters of possibility of regulating/banning these imports from India, in the context of the alarming occurence of banned antibiotics in cultured shrimp/prawn exported to these countries. In order to appraise the farmers and others concerned about the seriousness of the situation, MPEDA's Regional Centre at Vijayawada organized a meeting in Nellore on 23 May, 2002 at Hotel D.R. Utthamma. There were about 150 participants.

Mr. K. Jose Cyriac, Chairman, MPEDA, in his introductory address observed that antibiotics were banned from usage in shrimp aquaculture by the E.U., Japan and U.S.A. He cited the example of extensive use of Chloromphenicol in shrimp aquaculture in China which had led to a complete ban on imports of shrimp from that country by E.U. He added that exports worth around US $ 300 million annually were lost by China due to the ban. Since Andhra Pradesh happened to be the major producer of cultured shrimp/prawn (51,228 mt of shrimp and 20,910 mt of scampi worth of 2,900 crores) he emphasised the inescapable need to ensure that exported Indian shrimp/ prawn were free from antibiotics. He warned that not heeding to the signals of the situation that prevailed due to the ban on import of Chinese shrimps by EU and continuance of the antibiotic application practice would lead to similar imposition on Indian exports resulting in

Dignitaries on the dais L to R : Gopinath Sai, Deputy Director, Dept. of Fisheries, R. Ganapathy, Director, MPEDA, Jose Cyriac, Chairman, MPEDA, Elias Sait, President, SEAI, S. Gopal Reddy, President, Farmers Association, Nellore

Mr. Jose Cyriac, Chairman, MPEDA addressing the participants

Mr. R. Ganapathy, Director, MPEDA, welcoming the participants, told them that the annual value of exports of marine products from India for the year 2000 - 2001 were at a level of Rs. 6,444 crores. Out of this, Rs. 3,900 crores came from cultured shrimps. Pointing out that detection of banned antibiotics in the exported shrimp would lead to imposition of regulations or ban on import of Indian shrimp by the importing countries, he appealed for totally giving up use of antibiotics in shrimp aquaculture to enable Indian shrimp/ prawn exports to sustain in the international market.



A view of the participants. Mr. U.K. Viswanatha Raju, President, Coastal Aqua Farmers Association, Bhimavaram speaking on the occasion

substantial loss to the country. He also stated that the Ministry of Commerce and Industry had issued a notification prescribing residual limits of antibiotics, pesticides and heavy metals in fish and fishery products. Informing that the E.U would shortly be sending a team to India to verify the usage of antibiotics in aquaculture, he mentioned that so far five cases of scampi exported from India containing banned antibiotics residues, from Nellore region, came to light. In this back

ground, he called upon the farmers, technicians, drug manufacturers, feed manufacturers, hatchery personnel etc., in an insisting tone, to ensure that the banned antibiotics were not used in shrimp/ prawn culture.

Mr. Gopinath Sai, Deputy Director, Department of Fisheries, Hyderabad told that the Fisheries Department conducted a number of meetings of farmers to create awarness among them on the disaster they would have to face if they continued the use of antibiotics in aquaculture.

Mr. Samanthula Gopala Reddy, President, Nellore District Prawn Farmers Welfare Association told that the antibiotics were used as part of feeds and also in hatcheries and farms. Hatchery personnel were using maximum quantity of antibiotics during the larval rearing stages. Hence, one remedial measure would lie in hatchery managers minimising the usage of antibiotics in hatcheries. Another step needed was, for the government to ensure through a testing mechanism, that the different brands of feeds marketed by several companies were free from antibiotics. Regarding use of antibiotics in farms, pointing out, that farmers were the victims of the advice of technicians and consultants, he wanted MPEDA to register qualified aqua consultants so as to save the farmers from pseudo - consultants. He wanted that the concerned drug manufacturing companies should be prevented from manufacturing banned items and those who continued to manufacture them should be penalised. He suggested that MPEDA should take up registration of the companies engaged in the manufacture of harmful drugs.

On behalf of the Nellore District Prawn Farmers Welfare Association, the creation of a new organization like "Inland Aquaculture Development Authority" was suggested by him, so as to ensure that the needs of aquafarmers were effectively fulfilled. Considering that farmers were badly affected because of the exploitation by the middlemen, the prices of shrimp/prawn were fluctuating day to day, Gopala Reddy suggested that the exporters should directly buy the material by establishing purchase outlets at appropriate centres. For this, farmers association was willing to establish auction centres in each mandal along with chill room, pre processing centre and freshwater facility, he assured. He had also mentioned that the Association was ready to provide land for setting up the infrastructure. Requesting MPEDA to come forward to extend some financial assistance, he suggested that uniform prices for the procurement of scampi/ shrimp should be fixed by the exporters in an organised manner, through their association. Stating that MPEDA should initiate measures in this regard, he insisted that it should see that the hatcheries would supply disease free, quality seed to the farmers. Since farmers were losing the crop due to the lack of quality seed, he requested that an office of MPEDA may be set up in Nellore to cater to the needs of the farmers in the district.

Mr. Sridhar Reddy, President, Nellore District Hatchery Operators Association, said that hatcheries had minimised the use of antibiotics in hatchery operations. The farmers should abstain from taking PL 2 size seeds, he advised.

Mr. Rajaiah, President of the Nellore District Aqua Traders Association, insisted that MPEDA should take stern action against drug suppliers and seed suppliers, since antibiotics were routed through these two sources. The hatcheries should certify that the seed supplied by them was free from antibiotics.

Mr. Elias Sait, President, Seafood Exporters Association of India, explained about the problems faced by the exporters in the exports of shrimps to the E.U., Japan and U.S.A. markets, consequent to the detection of antibiotic residues in tiger shrimps and scampi. More and more farmers should be encouraged to venture into scampi culture, he said.

Mr. Rama Krishna, KVK, Nellore, said that pseudo-consultants were spoiling aquaculture and requested MPEDA to set up norms to regulate the activities of these consultants.

Mr. Kondalarayudu, President, Prakasam District Prawn Farmers Welfare Association pointed out that culturing shrimp without using antibiotics was very difficult. However, in Prakasam District many of the farmers started culturing shrimp by using probiotics. Mr. Vidyasagar Rao, President, Kandaleru Creek Farmers Association told that MPEDA should take appropriate steps to see that the farmers were given Aquaculture Authority licenses. He suggested that MPEDA might involve local fisheries college for research and development in shrimp/ scampi aquaculture or in alternative species culture.

Other progressieve farmers who spoke at the meeting also gave an assurance that they would avoid using antibiotics. They appealed to MPEDA to control the fluctuation in the procurement prices. The present financial assistance schemes of MPEDA should be continued, they said.

Mr. U.K. Viswanatha Raju appealed for upgradation of the office of MPEDA at Vijayawada. He suggested placing of a ban on antibiotic manufacturing units.

Mr. K. Jose Cyriac, Chairman, MPEDA, in his concluding remarks listed the points of follow-up action on the discussions as follows.

- The farmers should abstain from using of banned antibiotics in the interests of the all concerned.
- MPEDA will take stern action against the drug maufacturers if it comes across the sale of banned antibiotics for use in Aquaculture.
- Since farmers are using the same sources of water, they can form cooperative societies to sustain the aquaculture. Where MPEDA's participation is required, it may be involved.
- Farmers should be cautioned not to culture exotic species, as this is illegal and would bring new viruses. Government will take stringent action against such practices.
- He will discuss the price problems with SEAI and will try to resolve them.
- Due to the paucity of the technical staff, opening of an MPEDA centre at Nellore may not be feasible immediately.
- Present financial assistance schemes will be continued as they stand.
- Promised to work positively on the proposal made by the farmers association to establish preprocessing centre and auction hall..

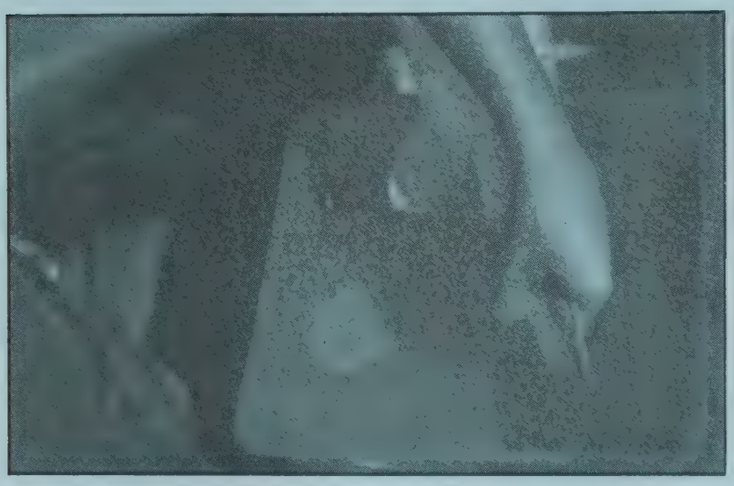
Threatened Masheer of Narmada : Conservation Efforts

Nishi Naryani and Praveen Tamot
M.P.Council of Science & Technology
Kisan Bhawan, 26, Area Hills, Mother Teresa Road, Bhopal 462 004

Narmada is one of the two west flowing rivers of Madhya Pradesh. It originates from hills of Amarkantaka in district Shahdol of M.P.,and has a stretch of 1280 km., draining through the hilly mountains of Satpura and Vindhyachal ranges located in the three States of Madhya Pradesh (M.P), Maharashtra and Gujarat. About 84% of the river stretch (1077 km.) flows through M.P, covering more than seven districts. For this reason it also known as life line of M.P.

Status of Mahseer in Madhya Pradesh

The fish fauna of the State reported by Zoological Survey of India (2000) comprises 172 freshwater species including four species of Mahseer *(Tor putitiora, T. tor, T. khudree,* and *T. musullah)* available in different compositions in different climatic conditions in various regions of the State contributing to biodiversity chart of the State. CIFRI reported 30.1% *Tor* Mahseer in total fish landings from Narmada river during 1958-59 to 1963. The complexion has now changed. A recent survey report (Shrivastava & Nath, 2002) for the stretch between Piparia and Harsud in Hoshangabad region shows 15.6% decline in commercial catches of *Tor tor*. This alarming situation engaged the attention of Govt. of India's ICAR unit for taking timely action to rehabiliate this endangered species of mahseer, which now faces the danger of becoming an extinct fish, may be in the near future.



Fertilization of Eggs

Tagging of fingerlings before release in Narmada River

Rivers are renewable source of energy. They are rapid removal systems of unwanted substances and are repositories of unmatched biological substances. Fish keep river water clean and potable through consumption of plankton. Thus they play a vital role to maintain equilibrium of riverine ecosystem and its biodiversity.

Mahseer is India's pride as a sport fish, a veritable tiger under water and it is at the top of the biological food chain of the river. The fish occurs in rivers in almost all States of India where it forms an important fishery. India's biodiversity is awesome and the country has monopoly of a God-given gift like Mahseer.

Causes of depletion of *Tor* mahseer in Narmada River

Undesirable human intervention in natural ecosystems disturbing their equilibrium is one factor responsible for *Tor* mahseer fishery deterioration. Construction of the Tawa dam, destruction of spawning grounds, sewage and industrial pollution, soil erosion from catchment area, excessive abstraction of water (Kohli *et al.* 2002), wanton destruction and poaching of brooders, inflow of pesticide-laden waters (ichthyotoxins) and other destructive interventions have been adversely affecting the mahseer population of the river. Mahseer migrates upstream into shallow running waters for spawning. During this period, the moving fishes, which are mostly gravid and are consequently sluggish in their movements become targets for merciless killing by men with sticks, swords, spears etc. (Das and Joshi, 1993). Similarly, the spent fishes, fry and fingerlings are caught during downward migration as the monsoon recedes.

Conservation Efforts

Alarmed at the depletion of mahseer fish stocks in Narmada system, ICAR has recently sponsored a project on 'conservation and development of mahseer' with

an outlay of Rs. 16.51 lakhs for implementation in Madhya Pradesh. The objective of the project is to develop strategies for conservation, development & management of the threatened Mahseer of Narmada and for improvement of ecological status of the river and its reservoir. The project is being implemented by M.P. Council of Science & Technology. As part of the project, a mahseer hatchery has been set up at Powarkheda Centre of Central Institute of Fisheries Education (CIFE). Rearing facilities are also available at this Centre and yearlings of mahseer from this centre are released into the rivers and its reservoir. Some of the findings and activities of the project are as follows:

Rearing of *Tor khudree* and *Tor putitora* at CIFE unit at Powarkheda : 2000 spawn of *T. putitora* and 7000 spawn of *T. khudree* were procured from the hatchery of Tata Electric Companies (TEC), Lonavla (7-9 mm. size). The spawn was released in two cement cisterns of 4' dia x 3' depth. In 90 days the spawn attained a size of 20-80 mm (fry). At this stage they were stocked in an earthen nrusery for further growth. On 25th January, 2001 appx. 600 fingerlings of *T. putitora* and 100 fingerlings of *T.khudree* with 86.7 mm (average) size were released in Narmada river. Before releasing, the fingerlings were tagged for further studies on recovery.

Artificial propagation and stocking of Mahseer in Narmada River

Kulkarni (1980) succeeded, for the first time, in the induced breeding of *Tor tor* in semi-captive conditions at Lonavla in Maharashtra, utilising the facilities provided by Tata Electric Companies. He followed the stripping method. The developmental stages of fertilised eggs, and larval development were studied by him in comparison with those of *Tor khudree*. Following the same methodology as followed by Kulkarni, *Tor tor* was subsequently bred on 3rd October 2000 at Narmada river side at Hoshangabad, by adopting dry method of stripping. The brooders were collected from fishermen who caught them from Narmada river near Hoshangabad, (Near Kothi bazaar Ghat). As a result of the induced breeding experiment conducted with these brooders, 5,500 golden yellow artificially fertilized eggs could be obtained. These were raised to spawn stage.

Further experiments on induced breeding of *Tor tor* were conducted. On 15th November 2001 at Kothi Bazar ghat and on 17th November, 2001 at Dongarwada ghat two sets of mahseer brooders were stripped following the dry method into a plastic tray. Eggs and milt were mixed intimately. The eggs were slightly sticky. They were washed in freshwater. Fertilised eggs were demersal, lemon yellow in colour. They measured 2.4 mm. in diameter. 15,000 fry could be raised eventually from them.

Natural fry collection of Mahseer

M.P. Council of Science & Technology, Bhopal in collaboration with CIFE, Mumbai has been collecting Mahseer fry from Narmada river, Hoshangabad. The fry are reared at CIFE's Centre at Powarkheda. When the young ones have attained a size of 75 mm. and above, they are released in selected reservoirs of Narmada valley.

In comparison to early collection records of lakhs of fry per day (Dubey, 1959) now only 2-5 thousand fry of *Tor tor* could be collected in a day, which shows a downfall in its population. Because of this, the number of collection centres is reduced, which is indicative of destruction of breeding centres due to change in environment.

About three decades ago, eight fish seed collection centres were identified in Narmada and about 0.5-100 million mahseer seed used to be collected from these centres annually (Dubey, 1959, 1984). In Hoshangabad region, Joshipur *Ghat* and Jarra *Ghat* are established seed collection centres (Dubey, 1984) where seed collection from each centre of the order of two millions during 1967-71 was reported by the Department of Fisheries, Government of Madhya Pradesh. Langer *et al.* (1986-87) described three collection centres in Hoshangabad, *viz.*, Joshipur *ghat*, Kharra *ghat* and Dongarwada *ghat*.

Under the ICAR - assisted project, Dongarwada was surveyed and it was found that it was still a reliable source of masheer seed. It is located at the left side of river Narmada, 3 km. downstream from railway bridge. A *chhipni* net was used to collect fry in to another traingular net locally called *pelli*. During the period 27th November, 2001 to 18th December, 2001, a total of 50,000 fry could be collected from this centre. Out of these, about 36,000 fry (72.3%) were identified as *Tor tor* and the rest consisted of minor carp varieties mainly *Chela bacaila* etc., and these were separated and the mahseer fry were stored in a hapa already erected in the river. These were later transported to Powarkehda. From Sethani ghat 40,000 fry were collected from 21st December, 2001 to 3rd January, 2002. Of these, nearly about 24,000 (60%) were identified as *Tor tor*.

Survey of fish market : In the present study, 323 specimens ranging between 201 and 520 mm. were collected from two markets of Bhopal *viz.*, Budhwara wholesale market, and Bittan fish market. These markets receive mahseer catches from Barna, Tawa, Kerwa, Kolar, Halali reservoir and Narmada river. The samples were collected in alternate weeks from each of the markets and the sampling was undertaken for one year (January-December, 2001). The fishes were measured after wiping out slime etc., with a dry cloth.

Age and growth studies through scale, opercular bones and otolith : These studies have been undertaken with the following objectives: i) To determine the age distribution, ii) To examine pattern of growth and iii) To make comparison of various population parameters between the polluted and the reference sites. The results of the study, now in progress, would be published separately.

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Members of MPEDA

The Ministry of Commerce and Industry, in its Notification dated 4th June 2002, has appointed the following as members of Marine Products Export Development Authority for a period three years from 4th June 2002.

A purposeful refinement in the notification is that all Commissioners/Directors of Fisheries of Coastal States have been given place in the membership. The membership also includes two persons from Bihar and one person from Rajasthan.

List of Members

1. Chairman	The Marine Products Export Development Authority, Cochin
2. Director,	The Marine Products Export Development Authority, Cochin
3. Mr. Ganta Sreenivasa Rao	Member of Parliament (Lok Sabha)
4. Mr. Prabhat Samantray	Member of Parliament (Lok Sabha)
5. Mr. Raju Parmar	Member of Parliament (Rajya Sabha)
6. Development Commissioner (Fisheries)	Dept. of Animal Husbandry & Dairying, Ministry of Agrl., Govt. of India
7. Director (Finance)	Department of Commerce, Ministry of Commerce & Industry, Govt. of India
8. Director/Deputy Secretary (Export Promotion-Marine Products), Union Dept of Commerce and Industry, Govt. of India	
9. Director/Deputy Secretary	Ministry of Food Processing Industry, Government of India
10. Commissioner/Secretary (Fisheries)	Government of Andhra Pradesh
11. Commissioner/Secretary (Fisheries)	Government of Gujarat
12. Commissioner/Secretary (Fisheries)	Government of Kerala
13. Commissioner/Secretary (Fisheries)	Government of Maharashtra
14. Commissioner/Secretary (Fisheries)	Government of Karnataka
15. Commissioner/Secretary (Fisheries)	Government of Orissa
16. Commissioner/Secretary (Fisheries)	Government of Tamilnadu
17. Commissioner/Secretary (Fisheries)	Government of West Bengal
18. Commissioner/Secretary (Fisheries)	Government of Goa
19. Mr. M. Sudarshan Swamy	Managing Director, M/s. Santir Aquatic Pvt. Ltd.
20. Mr. T. Raghunath Reddy	President, Association of Indian Fisheries Industry
21. Mr. Elias Sait	President, Sea Food Exporters' Association of India (SEAI), Cochin
22. Mr. Tara Ranjan Patnaik	Vice-President, Sea Food Exporters' Association of India
23. Dr. K. Haribabu	MLA, Andhra Pradesh
24. Mr. Abraham J. Tharakan	Regional President, SEAI, Kerala
25. Mr. Rajendra Nath Mishra	Managing Director, Sealand Fisheries Pvt. Ltd. and President, SEAI Orissa
26. Deputy Director General (Fisheries)	ICAR, Ministry of Agriculture
27. Mr. Ravi Ranjan Singh	Shakti Nagar, Near Hanuman Mandir, P.O. Tarvi, Dist. Chapra
28. Mr. Mahendra Singh Bhati Ex-MP,	Basalpura House, Outside Jassusar Gate, Bikaner, Rajasthan
29. Mr. Jitendra Singh	Patna, Bihar

Basic Requirements of an Organised Fish Market

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W.B. University of Animal and Fishery Sciences,
68, K.B.Sarani, Calcutta:-700 037.

Fish market can be defined as an authorised place where fish is brought in and displayed by sellers and sold by them for human consumption. This implies that besides observing usual hygienic conditions, the fish market must have facilities for maintaining low temperature to keep the fish in good condition. While it should preferably be located at places away from vegetable, meat or other food markets, other facilities like potable water, electricity and proper sewage disposal systems should also be available. An ideal layout of a fish market as per B.I.S. specification is given at Fig-1.

Fish market should consist of a number of fish stalls arranged in two rows. The entire market should be enclosed by a compund wall to prevent the entry of dogs, cats and other undesirable animals. Stalls should be surrounded by a verendah on three sides. Further, the market should have centralised services for water supply, fish storage and also icing facilities. Arrangements should be made for potable water storage tank with taps for supplying water to fish stalls. At one end of the market, two cold rooms each of size 4.80 x 3.60 m should be provided, one for fish storage and another for ice storage. A weighing machine for centralised weighment of fish is essential in the market. The weighing machine should be installed adjacent to the ice store. A wash tub near the ice store will help in washing fish before storage. Toilets should be provided for each row of stalls having panelled doors of dimensions 0.9 x 2.1 m. However, the doors for store rooms as well as inside walls should be insulated. The door can be of size 1.2 x 2.1 m. The doors for the entrances to the market as well as to the stalls should be of dimensions 1 x 1.5 m with fly proof net.

The ceiling of the market should be of asbestos cement plain sheets with wooden reepers. For better longevity and ease in operation, floor of the market should be covered with mosaic slabs over cement concrete 1:4:8, 40 mm metal, 100 mm thick. Exhaust fans as required should be provided in the stalls.

PVC crates should be used as containers for handling the fish in the market. The crates must possess good insulation properties with standard dimensions, weight, and capacity for ease of operations. At the same time they should be strong enough to withstand rough handling. Further, the crates should be of such a design that the melted water and exuding blood and slime accumulate at the bottom and flow out of the boxes for later cleaning of the bottom, and also the blood and slime all over.

To make the entire fish marketing system successful, apart from having an organised fish market, right marketing strategies are essential. For this, identification of consumers' needs and nature of demand for products and services is necessary. A proper co-ordination between quality and quantity, should be done keeping in mind the variations as required by different segments of consumers. Above all, a balance should be maintained among the various marketing parameters like price of the product, competitiveness, needs of the consumer and the producer.

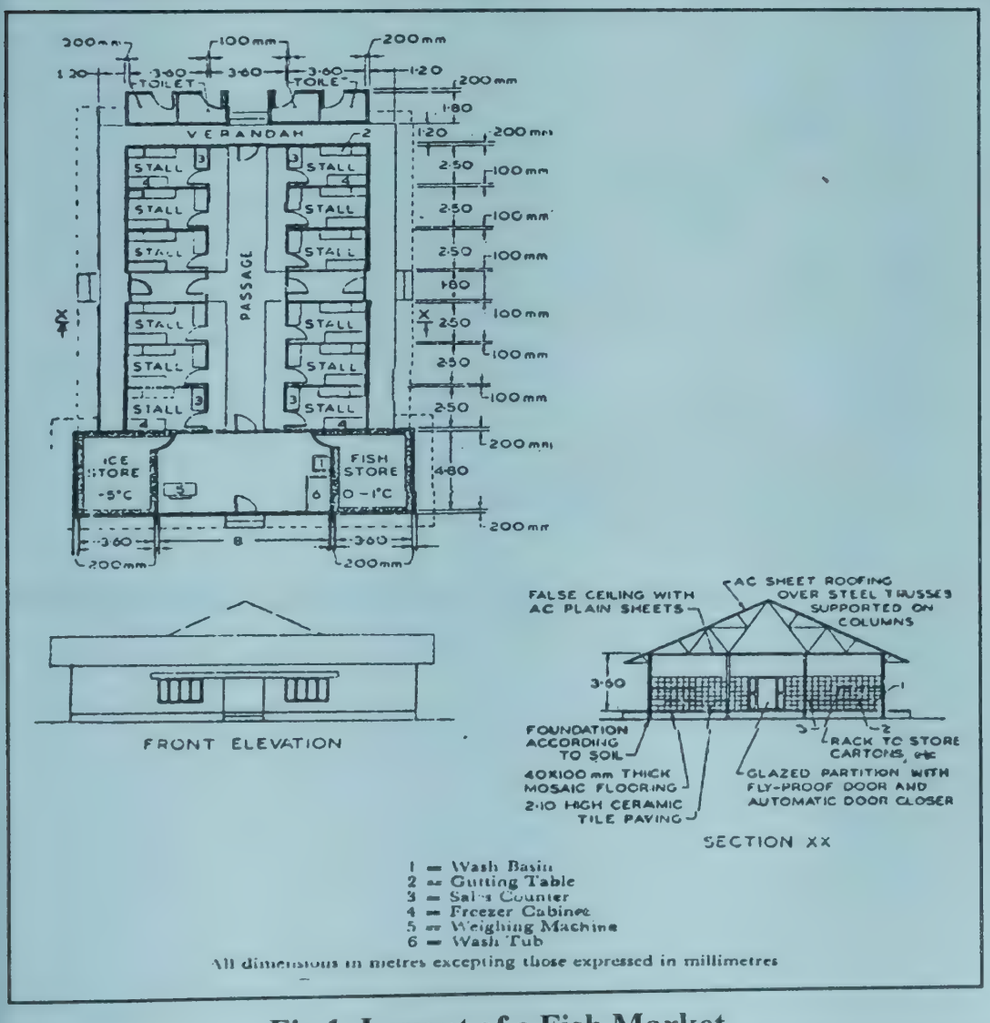


Fig 1. Layout of a Fish Market

Market Trends

(As in the week ending 13-06-2002)

Shrimp inventories in Japan are stated to be relatively good and therefore any tangible price increase may not take place for some time.

In USA imports have improved with increasing demand for shrimp. Thus, conditions seem to be congenail for stepping up shrimp exports to USA.

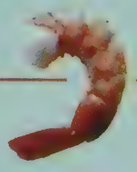
With Chinese shrimp exports to EU under ban, opportunities of augmenting exports of shrimps to that region are backoning and, same way as Thailand and others, these seem to be open to India for being availed of.

The cephalopod export market in India is at a low presently. Larger sizes are stated to be in short supply and for this reason many exporters are having problems in fulfilling their orders for larger sizes. For the present prices are relatively firm despite the supply position.

The following are the Indian export prices that prevailed in the week ending 13-06-2002.

Item	*Count range*	*Price range(S/kg)*
JAPAN		
HL BLACK TIGER		
Bhubaneswar	6/8 - 31/35	15.00 - 6.20
Kochi	16/20 - 31/35	10.00 - 7.10
Kolkata	8/12 - 61/70	16.50 - 3.50
Tuticorin	8/12 - 31/35	17.30 - 9.20
Visakhapatnam	16/20 - 31/35	11.10 - 7.50
HL SEA TIGER		
Bhubaneswar	U/5 - 21/25	20.50 - 9.00
Visakhapatnam	4/6 - 16/20	19.70 - 10.00
HL WHITE		
Bhubaneswar	8/12 - 51/60	16.50 - 4.00
Kochi	16/20 - 41/50	10.60 - 4.70
Tuticorin	8/12 - 41/50	14.45 - 3.82
Visakhapatnam	8/12 - 51/60	16.50 - 4.50
HL FLOWER		
Bhubaneswar	6/8 - 36/40	16.00 - 5.00
Tuticorin	8/12 - 61/70	17.80 - 3.80
Visakhapatnam	6/8 - 36/40	15.50 - 4.00
HL BROWN / PINK		
Visakhapatnam	11/15 - 71/90	10.60 - 3.70
PD SHRIMP		
Tuticorin	21/25 - 41/50	11.30 - 8.30
PUD SHRIMP		
Bhubaneswar	10/20 - Broken	7.20 - 1.80
Kochi	80/120 - 300/800	4.80 - 2.40
Kolkata	80/120 - Broken	4.60 - 1.00
Tuticorin	10/20 - Broken	8.00 - 2.00
Visakhapatnam	U/10 - Broken	8.10 - 1.80
SURIMI		
Mangalore	AA - B	2.30 - 1.30
SQUID FILLETS		
Tuticorin	1/2 - 41/60	6.30 - 3.40
USA & CANADA		
HL BLACK TIGER		
Bhubaneswar	13/15 - 31/40	13.15 - 7.25
HL BLACK TIGER (lb)		
Chennai	8/12 - 51/60	7.50 - 2.40
Kollam	8/12 - 21/30	9.60 - 7.65
Tuticorin	13/15 - 41/50	6.30 - 2.90
Visakhapatnam	8/12 - 41/50	7.30 - 2.90
HL WHITE (lb)		
Kochi	61/70 - 31/40	2.40 - 3.10
HL SCAMPI (lb)		
Chennai	6/8 - 16/20	6.50 - 3.00
Chennai (IQF)	U/5 - 21/25	7.80 - 3.20
HEAD ON SCAMPI (lb)		
Kochi	1/2 - 2/4	3.80 - 2.88
PUD SHRIMP (lb)		
Kochi	300/500 - 500/800	1.35 - 1.15
PUD TAIL ON (lb)		
Chennai (IQF)	26/30 - 21/25	4.75 - 5.30
PD SHRIMP (lb)		
Kochi	111/120 - 250/350	2.20 - 1.45
PD COOKED (lb)		
Kochi	111/130 - 275/350	2.55 - 1.85
BUTTERFLY SHRIMP (lb)		
Mangalore	21/25 - 61/70	5.54 - 2.59
EUROPE		
HL PINK		
UK	16/20 - 41/50	11.50 - 7.50
PD SHRIMP		
Belgium	31/40 - 110/130	9.50 - 4.80
Germany	16/20 - 51/60	12.00 - 6.50
PUD SHRIMP		
UK	100/200 - Broken	3.65 - 1.80
Germany	20/40 - 80/100	8.30 - 4.70
France	20/40 - 80/120	7.60 - 4.55
SQUID (Whole Cleaned)		
Portugal	20/40	1.65
Kochi	U/5 - 15/20	2.50 - 2.00
SQUID TUBE (IQF)		
France	80/up	1.60
CUTTLE FISH (Whole Cleaned)		
Italy (10% Glaze)	2/4 - 8/12	3.50 - 2.80
Portugal	U/1 - 3/7	3.20 - 3.25
Spain (10% Glaze)	2/4 - 13/20	3.10 - 2.15
SOUTH EAST ASIA & CHINA		
HL BLACK TIGER		
Thailand	31/40 - 91/110	7.50 - 2.70
FISH		
a) Silver Pomfret		
Hong Kong	300/400 - 600/700	4.70 - 7.50
b) Ribbon Fish		
China	100/200 - 700/UP	0.47 - 0.79
c) Mackerel		
Malaysia	2/4 - 10/12	0.90 - 0.80
CUT CRAB (Tuticorin)		
Korea	3L - Claw	3.60 - 0.80
SURIMI		
Singapore	3A - AA	3.15 - 2.97

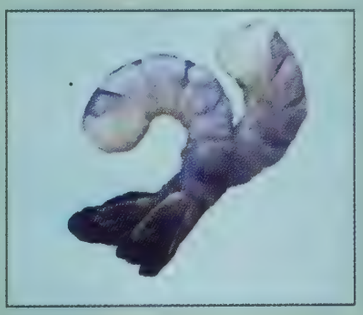
MORE THAN JUST QUALITY



Once step ahead of a changing world

Devi sea foods has always been in the forefront of delivering excellence in product & process.

The manufacturing practises at Devi are stricly in accordance with HACCP and EU guidelines and quality levels are constantly monitored at every stage to ensure the delivery of the best product to the ever changing needs of the global market.



Product profile

The phenomenal growth in exports and ever increasing customers of Devi Sea Foods, all over the world, is a clear testimony of the valuable products which are delivered to it's discerning buyer.

Devi's product range include :

*Indian black tiger/fresh water shrimp (farm raised)

*Head less /Head on

*PD tail on/ PD/ PUD

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Commercial Live Bearing Ornamental Fish Breeding: A Beginner's Delight

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Aquarists are familiar with the term 'live bearer'. Some of the most popular and best-loved aquarium fishes, like Guppys, Swordtails, Platys and Mollys, belong to live bearing category of aquarium fishes. These fishes are so widely available and well known that no 'first' aquarium can really be considered complete without atleast a few live bearing representatives. Yet, these popular fish represent only a small part of a very substantial group, consisting of nearly 950 species of fish that could be regarded as live bearers and scattered among some 40 families. It is certainly interesting to note that the world famous living fossil, a *Coelacanth,* is a livebearer.

In Central America, these small, colourful tiny livebearing fishes are very popular with the fish hobbyists due to the fact that, they accept all kinds of food and breed prolifically to produce living free swimming young ones. To retain any of these fishes of a pure colour strain, one must isolate them from contaminating crossbreeds and stock them in a number of tanks, but at least one for males and one for females, as well as in a few breeding tanks and in some aquaria for young ones.

Sword-tail

Black-molly

Guppy

Unlike other fishes, in the case of live bearers fertilisation is internal. Male counterpart transfers milt by an organ known as 'gonopodium' which is a modified anal fin. There have been reservations whether or not the gonopodium is actually inserted in to female body through vent. At one time it was believed that the gonopodium was a hollow tube that transferred milt into the female or atleast towards the female genital opening. Study with the help of a scanning electron microscope has revealed that in most live bearers, the gonopodium is grooved along its upper surface, and there is a hook like structure at the tip of the organ. The terminal hook is thought to serve as a means of enabling male to hold onto the female's genital pore, and that the grooved tube serves as a 'Launching ramp' from which the sperms are directed towards the female genital opening. It was also believed earlier that through gonopodium the transfer of milt took place but recent electron micro

Platy

scope study has revealed that the milt passes through the semi-circular grooved tube of gonopodium into the female body.

Among live bearers, mollys have enlarged sail like dorsal fin; platys, usually have rounded tail fin; guppy is a multi colour species, and swordtail is so named because the male has a long pointed sword like extension of the caudal fin.

There are no fixed boundaries for an aquarist's hobby and any one who has interest will find these indistinct boundaries uniquely attractive, exciting and challenging.

Live bearing species : Main Families

Most aquarium live bearing species belong to the following families: Poecilidae (Poecilids), Goodeidae (Goodeids) or Mexican Livebearers, Hemiramphidae (Halfbeaks) and Anablepidae (four eyed fishes). Out of these, Poecilidae family members are well suited to Indian climatic conditions and are very popular among the aquarium hobbyists of the country.

Live bearing species and their families

S.No.	Family	Species
1.	Characidae	*Corynopoma riisei*
2.	Oryziidae	*Oryzias latipes*
3.	Rivulidae	*Cynolebias brucei*
		C. melanotaenia
4.	Poeciliidae	(i) *Alfaro cultratus*
		(ii) *Gambusia spp.*
		(iii) *Poecilia spp.*
		(iv) *Poecilia reticulata*
		(v) *Xenodexia ctenolepis*
		(vi) *Xiphophorus spp.*
5.	Goodeidae	(i) *Ameca splendens*
		(ii) *Characodon lateralis*
		(iii) *Goodea atripinnis*
		(iv) *Skiffia francesae*
6.	Anablepidae	(i) *Anableps anableps*
		(ii) *Jenynsia lineata*
7.	Hemirhamphidae	(i) *Dermogenys pusillus*
		(ii) *Hemirhamphodon*
		(iii) *Nomorhamphus spp.*

Breeding of Guppy

The guppy (*Poecilia reticulata*) is a live bearing fish whose origin is in South America, north of Amazon but now it has spread worldwide. The probable reason for the global spread can be its ability to feed on disease-carrying mosquitoes. Guppys devour mosquito larvae, thereby helping in control of mosquitoes. Apart from aesthetic point of view, they look very beautiful in a group. The fish commands a greater demand in European countries.

Male guppy may reach up to 2.5 to 3.5 cm in length, while the females are usually large when fully grown. They thrive well in large well-designed community tanks in which a temperature within the range of 20-25° c is maintained. During summer, special cooling arrangement needs to be there to maintain the guppys in the range of water temperature (20-25° c) because, in many places, particularly in the tropics, temperatures rise to 37° c and even beyond during peak summer.

In the community tank the abdomen of gravid female starts to swell as the embryos inside develop into young ones and grow inside. At this stage they are removed and placed in breeding tanks (30 x 20 x 20cm) in groups. Plants like *Cabomba* may be planted in the tank, so that when the babies comes out, they get not only a shelter but also a hiding place to escape from mothers' predation.

For mass breeding of guppy for commercial purpose, a tank of size (100 x 100 x 60 cm) is ideal. A perforated basket (waste bin) could be provided in one corner of the tank wrapped with fibrous plastic flowing filaments, for the females to drop the young ones. Soon after the birth, the young ones escape from their mother and enter into the perforated basket and later the young ones can be collected from the basket and placed in a separate tank for further rearing. This exercise of using perforated baskets for breeding purpose helps in saving the young hatched ones from their mother's cannibalism, which is a characteristic phenomenon among live bearers. This method is practised at the Ornamental Fish Culture Unit of the Central Institute of Freshwater Aquaculture (CIFA) and this has been proven to be successful in terms of higher survival and economics. The brood females can also be placed inside the perforated baskets from which the young ones come out though the perforations after their birth. However, the

Most popular live bearing species and their distribution

Scientific Name	Common Name	Distribution
1. Molly		
Poecilia sphenops	Black molly	South America
Poecilia formosa	Amazon molly	Texas, Mexico
Poecilia tatipinna	Sailfin molly	Mexico, Florida, North Carolina
Poecilia mexicana	Short finned molly/ Atlantic molly	Mexico
2. Guppy		
Poecilia reticulata	Guppy (Millions Fish)	Arizona, California, Florida, Idaho, Texas, Alberta, Antigua, Venezuela
3. Sword tail		
Xiphophorus helleri	Swordtail	Atlantic slope, Middle America, Mexico
4. Platy		
Xiphophorus maculatus	Southern platy	Middle America
X. variatus	Variable platy	Mexico

former method is desirable because the brooders get enough space for their movement.

Breeding of Platy, Swordtail and Molly

The three live bearers platy, swordtail and molly are close relatives of the guppy and all of them originated from Central and North-Eastern South America. Adult livebearers of platy and swordtail take 6-8 weeks and molly, 12-16 weeks to mature. The method of milt transfer from male to female is the same as in the guppy.

After fertilization, the embryos grow into tiny young ones and become ready for hatching out as free swimming young ones within four weeks of gestation period. Althouth platys, swordtails and mollys are quite hardy fish, in no case maintenance of standard conditions in the aquarium in which they are maintained can be neglected. They breed well in most types of waters; so long as the water is not too alkaline or too acidic. Many of the mollys appear to benefit from addition of a little aquarium marine salt or common salt to the water (0.5-1 g/l). Maintenance of this salt level at every partial water exchange requires to be ensured.

Sex Reversal in Swordtails

The breeding habits of live bearing fishes are very interesting and these have attracted the attention of scientists across the world. Researchers observed the phenomenon of sex reversal in the case of swordtail (*Xiphophorus helleri*).

Each immature fish could develop into either male or female depending on which reproductive organs develop first. If the ovaries develop first, these will secrete female hormones (estrogen) and the fish will develop into female. In case testes develop first they turn out to be males because of androgen secretion. Later on in life, however, a female fish can turn into a functional male. Female to male change is common, but the reverse transformation is very rare. Sometimes, the external factors such as pH can affect the sexual development of some fishes. It has been observed that a low pH of 5-6 helps in developing more of males in the broods of swordtail and pH value more than 7.0 results in more of females.

Breeding Traps used for Livebearer Species

The term breeding trap is usually reserved for commercially produced plastic mini-tanks or containers in which gravid females can be placed when they are about to give birth to young ones.

When females of live bearer species are ready to drop young ones, they should be taken into breeding tank. In this tank individual or a group of gravid females can be kept in perforated nylon cages from where the young ones could escape from their cannibalistic mothers through the meshes to the outside. This system prevents parental predation. Various types of net cages, perforated waste bins, or fabricated, perforated containers can be used for this purpose. Depending upon the size of the net cages or traps,

Table-1: Adverse environmental conditions and related problems

S.No.	*Problem*	*Symptom in fish*	*Remedial measures*
1.	Chlorinated water	Restless movement, less of balance	Vigorous aeration for 24 hours.
2.	Ammonia load	Inflamed gills, and fin edges blood shot, loss of balance	Water exchange and aeration required
3.	Nitrites and Nitrate	-do-	Partial water exchange
4.	Oxygen and nitrogen (excess)	Gas bubble disease. Small bubbles visible under skin, in fins and around eyes, Exophthalmia (Pop eye)	Keep the tank away from sunlight, if algae or plants exist.
5.	Insufficient oxygen	Gasping at surface, loss of body colour.	Vigorous aeration is required with partial water exchange.
6.	pH		
	(a) Acidosis (pH 04-05)	Fast swimming movements; Gasping at surface. Fish jump out from water.	Avoid over stocking. Partial water exchange. Stop feeding temporarily.
	(b) Extreme Acidosis (pH > 04)	Sluggishness, tendency to settle in bottom and to hide, loss of appetite and colour.	Stop feeding, exchange water, and provide aeration.
	(c) Alkalosis (pH 09-10)	Serious damage to gills, disintegration of fin edges, body slime is excessive.	Avoid direct sunlight and exchange water partially.
	(d) Temperature (low)	Sluggish movement, resting at bottom. Fin and body movement gradually slows down. Loss of colouration.	Add ground water drawn through deep bore well, as part of water exchange exercise.
	(e) Temperature (high)	Increased level of activity (above normal) Increase in metabolism, increased rate of respiration, gasping at surface.	Addition of water or in an extreme situation thermostat also can be used if the tank is small. Add well water. Water exchange is very much essential.

Table - 2 Economics of small-scale breeding and rearing unit for live-bearer ornamental fish species

1.a) Capital Expenditure (Infrastructure)	*Rupees*
Land required (400 sq.ft.) own land	—
Low cost shed of 300sq.ft area (bamboo frame with net covering)	10,000
Breeding tank (cemented) 6' x 3' x 1'6' @ Rs.2500/tank (4nos.)	10,000
Rearing tank(cemented)6' x 4' x 2'0' @ Rs.2800/tank (2nos.)	5,600
Brood stock tank (cemented) 6' x 4' x 2'0'. @Rs. 2800/tank (2nos.)	5,600
Larval tank (cemented) 4' x 1'6' x1'0' @Rs.1200/tank (8nos.)	9,600
Bore well facility with 1 HP Pump	8,000
Oxygen cylinder with accessories (1 no)	5,000
Sub-total	**53,800**
b) Recurring Expenditure (for one year)	
Fish (800 nos. female + 200 nos male) @Rs.2.50/piece (Guppy, Molly, Swordtail & Platy)	2,500
Feed 150 kg/year @20/ kg	3,000
Different types of nets	1,500
Power charges @ Rs.250/ month	3,000
Perforated plastic breeding basket (20 nos.) @ Rs.30/ piece	600
Labourer @Rs.1000/ month	12,000
Miscellaneous (Chemicals, medicines, polyethylene packing material, bucket, gas filling etc.)	2,000
Sub-total	**24,600**
2. Total Recurring Expenditure	
Recurring cost	24,600
Interest on fixed cost (14% per annum)	7,532
Interest on recurring cost (14% half yearly)	1,722
Depreciation (20% of fixed cost)	10,760
Total	**44,614**
3. Gross Income	**76,800**
Gross income from sale of 76,800 nos fish @Rs.1/ piece, reared for one month (Fry production @ 40 nos/female/cycle from 3 cycles/year, and considering survival of 80%)	**Rs. 76,800**
Net Income (Gross Income-Total Expenditure) **Rs. 76,800 - Rs. 44,614**	32,186
Monthly income	2,682

the females can be stocked. A box or cylindrical device, but not a cage, can be fitted or hooked on to the wall of the aquarium for one or more mothers, whose newborns drop through the mesh opening into the lower space of the aquarium. When it is observed that the female has stopped dropping the babies, these should be removed and reared separately with special care.

Feeding for Breeding

There can be no problem whatsoever in providing suitable feed to most livebearers maintained in captivity. However, as is obvious, individual requirement and habits, such as the predatory life style of *Belonesox belizanus* (Pike Killifish), *Dermogenys pusillus* (Halfbeaks) and some *Gambusia* spp. need to be taken into consideration although, generally speaking, live bearers are omnivorous. This means that they normally accept both animal and plant based food. This applies even to those species that are regarded as herbivores (plant eaters), like many of the mollys. In fact, these fishes, particularly mollys sometimes, eat their own babies, proving beyond doubt that they can digest animal protein like any other carnivorous fish.

Though many livebearers enjoy a diet with composition that takes it to the vegetarian end of the nutritional spectrum, the feed composition should be balanced, providing proteins, carbohydrates, lipids (fats/oils), vitamins, mineral salts (trace elements) as needed and a bit of roughage (fibre).

A balanced diet as indicated above will provide wholesome metabolism covering growth and repair of tissues to the sustenance of their life itself. Therefore, during periods of growth or recuperation, diets that are slightly higher in proteins than normal (say, around 35%), may be found advantageous. At other times, lower levels of protein (around 25-30%) can be given in granular form. A compounded diet can be prepared by using locally available ingredients. It has been proved from a couple of experiments conducted at CIFA that feed containing less or no fish meal content showed better growth and early maturation compared to feed containing more of fish meal as a animal protein source. This shows that the fishes have a tendency to consume and utilise plant material than animal based feed.

Health care

As long as water quality is good and fish is provided with nutritious and well balanced diet, they will tend to remain healthy. There is, in fact, no doubt that most disease problems can be avoided through a common sense approach to management. Conversely, poor water conditions, inappropriate diet or mismanagement will cause stress, with all its associated problems. One adverse stressful impact is that it reduces the resistance of fish to pathogenic (disease causing) agents, to such an extent that they succumb to some ailment or the other. In adverse conditions, where the management is poor, some of the common diseases like white spot or ICH, caused by a protozoan parasite called *Ichthyophthirius multifiliis*, and fin rot caused by an external bacterial infection, are common. So far as non-specific diseases are concerned the symptoms can be usually seen when the environmental conditions are unfavourable. Some problems arising during adverse environmental conditions are given in Table 1 with

indicative preventive steps and remedies.

What a Beginner should do

The availability of many varieties of ornamental fishes with retailers, may tempt a beginner to breed or culture more varieties than he can handle but he has to control the impulse and proceed carefully. The first job of a beginner is to survey the market. He can start breeding of one or two live bearing species as discussed earlier for gaining experience first. One can, however, also start with several live bearer varieties, but infrastructure and manpower requirement would have to be ensured first. Eventually, when he learns about handling of these ornamental fishes and acquires skills to facilitate breeding by them over a period of time, he could diversify in to breeding of oviparous species and the concomitant post breeding activities until the stage of raising adults.

Collection of Fish for Breeding and Culture

It is not advisable to buy broodstock from the market directly. Instead, a beginner can think of buying the same directly from a farmer or organised breeding centres from where he can receive healthy and pathogen free stocks. Always it is better to collect the young ones from the farmers and grow them to build up the broodstock. In the event of purchase of stock from retailers or any other source, quarantine procedures must be followed.

Middle-aged young ones of one inch length or little less are preferable for purchase, as these would require sixty days to reach brooder stage. As already mentioned, live bearers are hardy by nature and can be well maintained by a beginner. Livebearers are omnivorous and hence artificial feed in a powdered and granular form is well accepted by them. For improved breeding efficiency, natural collection of mixed plankton can also be provided to the livebearers, in addition to prepared granular feed. Feeding with mosquito larvae is the easiest way, as they can be collected in sufficient quantity. Lastly a beginner is advised to undergo a comprehensive training in breeding, feeding and health care aspects of ornamental fishes. For the benefit of farmers, private entrepreneurs, state fisheries extension officers, MPEDA officers, college teachers, students and others, the Central Institute of Freshwater Aquaculture (CIFA) conducts training courses. CIFA also conducts training programmes every year.

Cost-benefit analysis

The economics of a small scale breeding and rearing unit for live-bearers ornamental fish species are given in Table 2. It is estimated that, within a year consisting of three breeding cycles, a beginner can earn a sum of Rs.2,682 per month. If a farmer does the breeding and rearing work single handedly, he/she can add the labour cost into the income. It is imperative to note that upon acquiring further expertise the farmer can enhance his income by two ways i.e., increasing the number of breeding cycles in a year and standardising the overall hatchery procedures that would further reduce the expenditure on feeding.

An entrepreneur can start making profit from the very first year itself, once he undertakes ornamental fish culture on sustainable and viable lines as explained.

Conclusion

In spite of having a huge potential demand of ornamental fishes in the domestic as well as in international market, and possessing a congenial environmental conditions of tropical and sub-tropical climate in the country favouring the growth and general upkeep of fish health, this sector has not yet received due attention as it ought to receive. The export of ornamental fishes from the country started only during the year 1969 with a few species of tropical freshwater fishes with insignificant export earnings, which increased to Rs.87 lakhs, in the year 1997. Presently the private entrepreneurs and village backyard units as commercial enterprises are coming up for ornamental fish production. MPEDA offers a subsidy of 50% (to a maximum of Rs. 80 thousand per unit) to the entrepreneurs, ready to develop a small commercial ornamental fish unit. With the growing interest of the farmers and entrepreneurs, especially among unemployed youth for establishment of small scale units of ornamental fish, no doubt this activity will soon occupy a significant position in the fisheries sector.

Acknowledgements

The authors wish to acknowledge Dr. S. Ayappan, Vice Chancellor, CIFE (Deemed University) Mumbai; Dr. R.K. Jana, Principal Scientist; Dr. K. Janakiram, Present Director of CIFA for their constant encouragement in this field of work. Our heartiest thanks to Dr. J.K. Jena, Scientist (SS), Dr. Snehasish Mishra, GVT, Purulia for their kind help for preparation of manuscript.

Government regularises import of 32 Vessels

Readers are aware that, in pursuance of the amendment made by the Ministry of Commerce in the import regulations which has the effect of allowing import of used fishing vessels from abroad, subject to clearances needed, several enterprises imported in all 32 vessels several months back. It is stated that there were several flaws in the imports, which have led to their apprehension by the coast guard, and consequential cessation of operations almost all of the them. The enterprises concerned are understood to have gone to the court. They told the court that the imports made by them were strictly in accordance with the amendment of the import rules made by the Government and they were not at fault. Objections were however raised by the authorities that the documents provided by most of the importers were not in order.

In this background, there is a report that says that the Government of India (Union Deprtment of Animal Husbandry and Dairying) has confirmed the right of fishing by 16 tuna longliners out of the imported lot as the imports were in order. Most of these vessels are stated to be of Taiwanese, Mainland China and Thai origin. It has been clarified that these vessels are now free to conduct fishing in Indian EEZ. The report also says that the Government will soon be issuing a notification on the subject.

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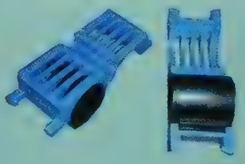
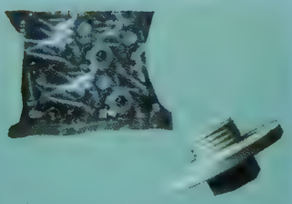


Bearing Cover& Rubber Bushing

Bearing Stand

Plastic Shaft

Plastic Frame



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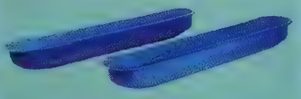

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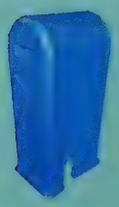
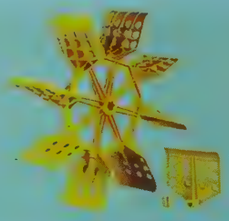


PE Cover



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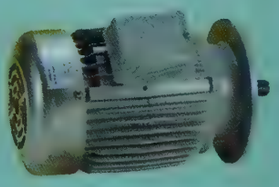
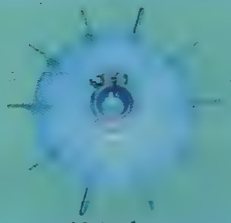
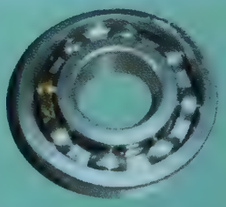


Motor

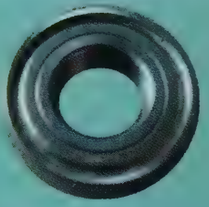
Reducer(14:1)



Motor fan



Reducer Bearing #6306



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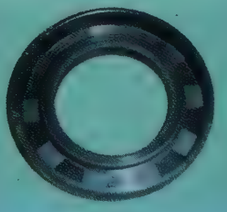
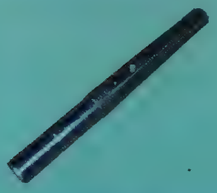


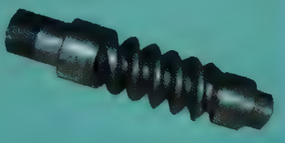
Oil Seal



Output Shaft

Worm Gear Wheel (14:1)

Reducer Bearing #30305



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Rajasthan Newsletter

From : V.S. Durve

CIFE's Training Programme in Brackishwater Aquaculture in Udaipur: 13 - 18 May 2002

CIFE Mumbai and C.I.B.A. Chennai jointly organised a training programme on Inland (In contrast to coastal) Brackishwater Aquaculuture at Udaipur from 13-18 May 2002. The venue was the premises of Fisheries Training School of the State Department of Fisheries, Udaipur. The participants were almost exclusively drawn from the state fisheries department's technical staff at senior and mid-management levels.

The training programme was inaugurated on 13th May by Prof. V.S. Durve, Ex. Professor and Head of the Department of Limnology and Fisheries, Maharana Pratap Agricultural University, Udaipur. In his inaugural address, Prof. Durve extensively dealt with the Inland Brackishwater culture opportunities in Rajasthan which 'has the highest hectarage of such water resources in India'. Enumerating the available candidate species for such an enterprise, Prof. Durve named and suggested the possibility of the emergence of several new fish and shellfish candidate species for the purpose. The high porosity of Rajasthan soils, wider temperature fluctuations and the need for evolving suitable feed for the prospective culture species was also highlighted by him. He emphasised the need for research inputs in this field. Since some of the participants were very senior persons both in age and status, Prof. Durve exhorted them to be younger in mind to imbibe the new ideas, trends and technologies evolved in the fisheries field.

The syllabus of the programme, among others, contained the biological and culture techniques for different culturable fish and shell-fish species, culture of Artemia, water quality management, energy dynamics and productivity assessment in brackishwater aquaculture. Immunodiagnostics in shrimp health management, environmental issues related to saline water aquaculture and case studies of experiments conducted at Bharatpur and IGNP command also formed part of the training syllabus.

Sh. Sidharth Verdia, Principal, Fisheries Training School, Udaipur, welcoming the guests on the inaugural day (Sitting from left; Dr. K. Pani Prasad, Dr. V.S. Durve, Sh.C.S. Chaudhary and Dr. Atul Kumar Jain)

The faculty was drawn from CIFE Mumbai, CIBA, Chennai and the Department of Limnology and Fisheries of Agricultural University, Udaipur. Dr. A.K. Jain, Senior. Scientist from CIFE directed the programme. Dr. A.R.T. Arasu, Principal Scientist from CIBA and Dr. K. Pani Prasad and Dr. S. Raizada, Senior Scientists from CIFE, acquainted the participants with the latest techniques in 'inland' brackishwater culture. The participants were shown the copious stocks of Artemia developed in the laboratory's cement cisterns from the cysts obtained from elsewhere, indicating the possibility of intensive Artemia culture prospects in Rajasthan.

The valedictory function was held on 18th May with Mr. Bhaskar Sawant, Addl. Commissioner, Udaipur Division and Managing Director, Rajasthan Tribal Area Co-Operative Development Federation, Udaipur in the Chair. The chief guest was Dr. L.L. Sharma, Head, Department of Limnology and Fisheries, Agricultural University, Udaipur.

Mr. C.S. Chaudhary, Joint Director of Fisheries, Rajasthan was the Chief Guest. Mr. Chaudhary in his address thanked CIFE for initiating brackishwater research and training facility in Rajasthan and appealed to his trainees and other staff to take the full advantage of this new technology and take the same to grass-root level of private aquaculturists in the saline region of Rajasthan, who are novices to this new art of generating income from the otherwise worthless slat-water bodies and salt lands."

Sudarshan Swamy nominated as MPEDA Member

The Ministry of Commerce has nominated Mr. Sudarshan Swamy, Managing Director of santir Aquatic Ltd, Visakhaptnam, and President, A.P. Shrimp Hatcheries Owner's Association as a member in the Management Board of MPEDA. His nomination on the Board is widely welcomed as he would be able to present to the Board the problems of shrimp hatcheries, when have to play a crucial role in the production of disease-free shrimp seed for supply to farmers.

Mr. Sudarshan Swamy has been in the aquaculture business for the last 13 years. He was the first farmer to take up scientific shrimp farming in Vizag district of A.P., in 1990. He also established the First World Bank assisted Shrimp Seed Hatchery in East Godavari District of A.P.


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